THE

Practical Teacher

A MONTHLY EDUCATIONAL JOURNAL

Edited by JOSEPH HUGHES.

'*Knowledge is proud that he has learned so much,*
Wisdom is humble that he knows no more.'—COWPER.

VOL. III. No. 9. NOVEMBER, 1883. PRICE 6D. POST FREE, 7½D.

The Teacher's Health.

BY ALFRED CARPENTER, M.D. (LOND.), M.R.C.P. (LOND.), C.S.S. (CAMB.),

Vice-President of the British Medical Association.

THROAT AND VOICE.

If observation is directed to the customs of some of those affected by hoarseness, it will be seen that they do not use the respirator which Nature has given them. There is no natural evil which a kind Providence has not guarded against, and given us protection from its effects, when it is required. It is so as regards the larynx. This organ is most delicate. Like to the ear it has a wonderful set of nerves and muscles, regulated both by the will and also by involuntary action. It has numerous cartilages which strengthen its softer parts. There are filaments called the vocal chords, regulating the size of the aperture which constitutes the gate of life (janua vitæ). This aperture is a slit between the chords, and is called the 'rima glottidis' (the slit or chink of the glottis). This chink is covered by the epiglottis, which answers the purpose of a lid to cover over the slit when the act of swallowing is performed. Foreign substances are thus prevented from entering the larynx and passing into the trachea (or wind-pipe) when food or drink is swallowed. This does happen occasionally by accident when a person laughs, or is seized with some sudden and irregular muscular action whilst in the act of swallowing. The vocal chords are four in number. The two which are inferior produce the sound of the voice by their vibration. The rima glottidis is between these two. The chink is lancet-shaped, the point being turned forward and it widens behind. It is nearly an inch long in the adult, and about a third of an inch wide in its widest part, its dimensions being less in the female. The superior chords or false vocal chords are much wider and less defined than the true. The ventricles or sinuses of the larynx are between the chords. They form 'cul de sacs,' named the laryngeal pouches. All these parts are lined with very sensitive membrane, which is supplied abundantly with nerves from the superior laryngeal branch of the great pneumogastric nerve. It is upon the correct application of these parts to each other, and their ability to respond to the impressions made upon them, that the delicacy of the sounds of the voice has its origin. The muscles which regulate the movements of the membrane are excessively minute. Their action is both voluntary and involuntary, and any disturbance in the function of the part, either by relaxation or over-action, produces an alteration in the capacity of the membrane to respond correctly to the nervous stimulus, and to regulate the tone which is required, closing the chink or vibrating the chords as may be necessary for the production of the required tones. In man the power of song is entirely acquired. Early education of the muscles of the throat, assisted by the organ of hearing, produces the most perfect musical instrument that can ever be constructed. The power of speech is to some extent independent of the larynx, but that of song is distinctly associated with the perfection of this organ. We may whisper without any laryngeal vibration being produced, the action arising from the vibration of air in the mouth from back to front; but laryngeal tones may be produced without articulation, they are not necessarily associated with words. If we bear these distinctions in mind we shall see some of the reasons for hoarseness and loss of voice when the mucous membrane is disturbed in its proper function, or when it is too moist, or less moist than it ought to be. This disturbance is brought about by intemperate action in declamation, by the too long continued strain which the muscles have to endure sometimes, and in the irritating nature of the air which is directly applied to the membrane. The respired air ought always to be within certain limits as to temperature. Nature gives us a means whereby these limits may be preserved. She has provided a respirator which will warm or cool the air we breathe if we will only use it properly, viz., the nose. The structure of this organ is so arranged, that it presents a very large expanse of mucous membrane over which the air has to pass, and by means of which it is both filtered and warmed. If we would always use the nasal organ as the proper apparatus through which air should enter the lungs, there would be much fewer laryngeal disturbances than are now met with. This caution is more especially necessary to be thought of and acted upon by those who have delicate throats than it is by other people. It would diminish delicacy of the vocal organs without making them more tender, if all persons would breathe

BRITISH MUSEUM

through their noses instead of using their mouths for that purpose.

I mentioned the source of the nerve influence as coming from the pneumo-gastric. This is an important factor in connection with throat affections, for they are very often associated with the stomach. Indigestion is reflected upon the organ of the voice, hoarseness and relaxed throat is often kept up by errors of diet, and if with this discomfort there is also the custom of walking about with open mouth, the larynx is sure to suffer sooner or later, and changes in its functional and muscular performances will be produced.

It is curious to see how careful some persons are to indicate that Nature has been careless in her work, and left them unprotected. They wear some kind of respirator over their mouths, through which they breathe, and neglect the far more useful one which is always at command. One sees them go about the streets open-mouthed, and if the artificial respirator is not forthcoming, they suffer from an irritating cough or disagreeable hoarseness, because the particles of solid matter which are always present in the atmosphere of towns, are filtered in the larynx instead of in the nose, or the air respired is too cold for an over-sensitive membrane, which then resents the treatment. I strongly urge the teacher to follow nature, to use the nose instead of the mouth, and do away with those mischievous articles of clothing called respirators. This advice does not apply to the working man who may be toiling in a dust-laden or otherwise poisoned atmosphere. In his case it is as necessary as any other kind of protection against the evils of civilization. His work compels him at times to breathe through his mouth, and respirators are a part of his harness when he is at work. Respirators only provide work for the special physician when they are used in everyday life, for they render the throat more sensitive and less able to bear those sudden changes of temperature and moisture in the air, which may come on at any time without warning. There are times when delicate people may wear them, but, as a rule, if there is a dense fog or a stifling atmosphere, caused by the presence of half-consumed products from a forest of chimneys, it is better for such people, if they can do so, to avoid exposure rather than to seek it. If they are obliged by the force of circumstances to brave its effects, then a veil with a double fold over the mouth, which shall to some extent leave the nose free, will be all that should be employed, unless by medical advice.

One of the most frequent sources of weakness in the throat and susceptibility to soreness and relaxation is provided by letting the feet get cold or be wet. Some persons always have cold feet in cold weather. It will be found that those persons are or have been accustomed to wear tightly-fitting boots and shoes. If children had never been accustomed to wear such things, they would never be troubled with the sequences of cold feet, any more than they suffer from cold fingers from not wearing gloves. The Scotch, Irish, and Welsh children used, until very recently, to run about without coverings to the feet, and were able to enjoy the comfort of warm feet in the coldest weather, but as soon as they became accustomed to the use of leather coverings, the power to withstand the effects of cold was lost.

It would be a great advantage, at least in elementary schools if children could be encouraged to do without shoes and stockings. They are not necessary, except from habit; their absence is often made an excuse for keeping children at home, whilst in many cases they encourage unhealthy dirt, and cover up that which ought to be rubbed off by contact with the best deodoriser which can be provided, viz., the vegetable and mineral matter contained in the soil. In such schools (if they should develop) a place should be provided for feet-washing, as well as for cleansing other parts of the body. In those districts in which this arrangement could not be carried out, it is highly important that the boots and shoes should have thick and impervious soles, so that the feet may be kept dry; also that there should always be sufficient room for circulation to be active, and the feet to grow. Tightly-fitting stockings and shoes, by preventing active circulation, lead to a diminution of the calibre of blood-vessels, and, therefore, to a diminished supply of blood. There is a diminished supply of heat, and as a consequence cold feet are certain to be present.

If people with tender throats provided themselves with plenty of blood-supply by allowing a free circulation in the feet instead of using artificial warmth by means of hot bottles, foot-warmers, and all such luxurious articles, they would find themselves much less sensitive than they are. Nothing has tended so much to increase throat affections among the delicate as the use of tight boots, with the foot-warmers which are now supplied on most of our lines of railway. Very comfortable, no doubt, but it is very unwise under any circumstances for people in average health to trust to artificial supplies of warmth instead of providing it for themselves in themselves. Those who have delicate throats should be careful not to talk much when in the open air, if it is foggy or very cold. Talking requires them to open the mouth too much, and to some extent prevents them from breathing through the nose, and employing Nature's respirator.

As boots and shoes must be worn they ought to be kept dry. It would be a great advance in day schools for the scholars and teachers to have a pair of dry shoes at the school which they could change on wet days for their wet ones. To sit all the morning in damp garments tends to promote the formation of a foul atmosphere, to chill the body and render the teacher, as well as the scholar, more prone to take on enthetic disease if it happen to be in the school. It gives the teacher no chance of having pure air in the class-room.

The custom of wearing india-rubber goloshes is not to be encouraged, unless there is snow on the ground, and even then, snow fur-boots are better. They should only be worn out of doors. Goloshes keep the feet very hot, and when they are taken off, the feet miss the warmth and the owners are like to those who have travelled a long journey with a hot foot-warmer which has become cold and which cannot be renewed: they miss the warmth to which they have become accustomed, and suffer in consequence. They are like to naturally hardy plants which have been kept in a hot-house. They are quite unable to stand the consequences of cold, which they could have easily borne, and even have been strengthened thereby, if they had not been weakened by over-indulgence.

Sore Throats.

Sore throats are of several kinds, viz., (1) Common sore-throat. (2) Acute sore-throat. (3) Quinsy.

(4) Aphthous sore-throat. (5) The sore throats of small-pox, measles, scarlet fever, diphtheria. (6) Acute laryngitis. (7) Chronic sore-throat, sometimes styled 'follicular sore-throat.' (8) The clerical sore-throat. There are also (9) Enlarged tonsils. (10) Tumours growing in various parts. (11) Neuralgic conditions. (12) Spasms in the throat. (13) Naso-pharyngeal catarrhs; and, lastly, (14) Chronic coughs consequent upon mucous disturbances of the throat, and which can only be cured by directing attention to the source of the evil.

(1) *Common sore-throat or simple catarrh.*—There is general relaxation of membrane, with some hoarseness and uneasiness, but not actual pain on swallowing. It is very common among children, and often arises from exposure to cold after being in an impure atmosphere. If it be simple relaxed throat it requires an equable temperature, a slight aperient with diluent drinks, so as to encourage diaphoresis, and no solid food should be taken. If there be fever, especially if there be pain on swallowing food, or any constitutional disturbance, medical advice should be sought for, as it is very difficult for the inexpert to detect the serious consequences which may arise from laryngitis or diphtheria. Two drops of tincture of aconite, with five grains of chlorate of potass every three or four hours will relieve the inflammation; this is also a most invaluable medicine in acute sore-throat, taking down the inflammation in a rapid manner: it may, in the latter case, be taken every hour or two, and continued until all pain on swallowing is gone.

(2) *Acute sore-throat*, which is sometimes called pharyngitis, is an inflammation of the mucous membrane of the throat. Changes have advanced beyond the relaxed stage. There is usually fever and restlessness. It will get well in a few days if it is not illtreated by caustics and other irritating measures, which are sometimes injudiciously used. It requires warmth, diluents, diaphoretics, and saline aperients. The free use of mucilaginous drinks, such as barley-water or linseed tea, and occasionally iced water or iced milk-and-water, will be the most successful line of treatment.

(3) *Quinsy* has been treated of in 'School Surgery' (*vide* Vol. II., page 375). Warm fomentations may be used to hasten the discharge of matter from the abscess. It is frequently associated with teething. Some children have an abscess in one or other tonsil with each tooth that is cut. Quinsy is usually preceded by a chill or rigor. This is followed by fever. It is sometimes accompanied by a most acute pain in the ear in consequence of pressure upon the Eustachian tube, and the interference with discharge from the middle ear into the throat. There is often a nervous fear less suffocation should arise. This has really never happened from simple quinsy, and need not therefore be feared.

(4) *Aphthous sore-throat* has a relaxed state of mucous membrane; there is a series of white spots upon the tonsils, and often, also, upon the tongue and gums. They are occasionally, even frequently, mistaken for diphtheria, and mistreated accordingly. The spots are seldom more than two or three lines in diameter, pale, ashy-looking, at first they are like blisters or papules in the skin; the mucous membrane is then denuded and slight indented ulcers remain; sometimes the mucous membrane swells up and the indentation is not so manifest. They may then appear as if there was a membranous production upon the mucous surface. Those upon the lips and gums are easily cured if they be touched very gently with a solution of nitrate of silver, so that the solution be applied only to the ulcer.

(*To be continued.*)

—o—

Friedrich Fröbel.

BY HIS PUPIL, HERR HEINRICH HOFFMANN, KINDER-GARTNER, ALTONA,

President of the Fröbel-Verein.

IV.

The spell was broken! Fröbel felt as if suddenly released, yet he could not conscientiously respond at once to this unexpected call. He naturally hesitated to accept his friend's offer, and thus relinquish all the plans and hopes which he had cherished for so many years. An accident decided his course. To his utter dismay, he learnt that all his testimonials and certificates, indispensable for obtaining a situation, had been lost. That was a heavy blow indeed, but after the first excitement had subsided, he looked upon it as the guiding finger of God, and being convinced of this, he confidently agreed to Herr Gruner's proposal. The 'model school,' of which Herr Gruner was the head master, was based on a new system, which excited the greatest interest not only in the educational world, but also among all the thinking classes of society—a system, than which no other has initiated a greater revolution in popular education within the last century: we allude to that produced by Pestalozzi's earnest labours.

Human language could hardly give proper expression to that enthusiastic idealism which swelled the grand soul of Pestalozzi. It was responded to by a frantic echo from the whole nation. Idealism, manifested in high-flown, though not always practical, aspirations towards the godly, the noble, the sublime, was the general spirit of those turbulent times—a natural reaction, perhaps, from that rough, relentless barbarity, for which the Napoleonic wars earned such an unenviable renown. It was the necessary consequence of all the miseries, all the degradation, which the Germans had to endure, and in accordance with the 'law of opposites,' as Fröbel has it; just as in our days cold materialism is said to be prevalent as the natural outcome of individual and national prosperity.

No wonder, then, that the universal watchword 'Pestalozzi' should have re-echoed in the heart of such an idealist as Fröbel was. Did not that name recall some stirring sensations experienced in the very early days of his boyhood, when he had been deeply impressed by a newspaper paragraph which referred to a man in Switzerland, 'a certain Pestalozzi,' who lived quite solitary and retired from the world, and, at the ripe age of forty, had by his own unaided exertions completely mastered the three R's? It was Fröbel's invariable method to refer the experience of others to himself, and so, mournfully reflecting on the slow and unsatisfactory progress of his own tuition, he had derived refreshing comfort from that case, and new and joyful hopes of a similar experience. From that time the name of Pestalozzi had stood high in his esteem.

Now, Gruner himself and one of his assistants had both been pupils under Pestalozzi, of whom they were enthusiastic admirers. Gruner, therefore, was highly

gratified to see Fröbel enter into the ways of the school with so much ardent zeal, and he took much pains to reveal to him the peculiar methods of his own great master. Furnished with all the books and publications on the new movement then extant, Fröbel read eagerly, and was overjoyed to discover in them principles so congenial to his own. Everything he heard and saw of the new movement and of its author affected him deeply; but when he read in a literary periodical: 'Pestalozzi's fervent longings and aspirations aim at the establishment of a Training Institution for the *poor* wherever it may be feasible,' his enthusiastic admiration knew no bounds, and at once he determined to see with his own eyes, and at work, the man who could conceive such a plan in his mind. It happened, fortunately, to be the midsummer holidays. So in three days, about the end of August, 1805, Fröbel was on his way to Yverdun.

His friends had provided him with letters of introduction and warm recommendation; so he was very kindly received, and admitted to all the lessons. What he heard and saw inspired him with high admiration, but also with the discouraging consciousness of how little he himself as yet knew. He felt alternately elevated and depressed.

He could only remain a fortnight in gratifying his desire to see Pestalozzi at work; it was but a bird's-eye view. He saw enough, however, to satisfy him as to the immense importance of the movement, and to lead him to decide that, cost what it might, he would study more thoroughly at some future period both that hero and his work, at the feet of the master himself.

Nevertheless, that short visit was not without some immediate benefit to his class, more especially in geography; and at the next public examination his was declared to be the model class, and also his lessons in drawing, in orthography, and in arithmetic were acknowledged to be highly successful.

For two years he worked faithfully at Director Gruner's. An extract from a letter to his brother Christoph may give us a glimpse of the state of his mind at this period, the great turning-point of his life:—'I feel that I have found at last that something, so long veiled in mystery, so ardently desired, so sadly needed, the true element of my life! Indeed, I feel as happy as a fish in the water, as a bird in the air.' And in another letter he says:—

'I must candidly tell you it is really wonderful how happy I feel in my present pursuits. From the very first hour they did not appear strange or unfamiliar to me in the least, just as if I had been a teacher ever so long, and were born for nothing else. In vain do I try to depict to you this strange experience of mine. I felt as if I had never wished to be in any other walk of life, and yet I admit that I never entertained the least idea of working in a public school. During my lessons I feel myself completely in my element. You cannot think how pleasantly those hours pass away. So dearly do I love the children—all of them—and I always yearn for the time of being in their midst. You ought to see me at work, to see how thoroughly happy I am. Surely you would share my joy, and it would do you good. That pure happiness, I presume, is principally due to my consciousness of the high aims of my pursuits, *the education of mankind*, though certainly also in part to the warm-hearted affection which the children show me.'

On his aspirations at that time he expresses himself thus: 'I mean to educate men who stand with their feet rooted in God's own soil, in nature, whose heads, towering to heaven, read its secrets; whose hearts unite both heaven and earth; both the manifold life of earth and nature, and the serenity and peace of heaven; both God's earth and God's heaven.'

Fröbel's friend, who first led him to Frankfort, had introduced him to the high patrician family of Herr von Holzhausen. In course of time they wished to engage his services for private lessons in German and arithmetic for their three sons. Frau von Holzhausen was a lady of high intellectual culture, sublime in her simplicity, in her fervent love of humanity, a model wife, a model mother, a noble representative of matchless purity, whose every thought and action centred in the welfare of her family and in the education of her children. In her Fröbel found a counselling, sympathising friend; imperceptibly she took his education in her hands, and became to him a mother in the highest and noblest sense of the word. It is touching to reflect on the high veneration, the pious gratitude which he entertained for her throughout all his life.

(To be continued.)

—o—

Physiology.

BY ARTHUR NEWSHOLME, M.D. LOND.,

Gold Medallist and University Scholar, Physician to the City Dispensary.

Chapter VI.—THE MUSCLES.

By means of muscular tissue all the active movements of the body are produced. The only exception is in the case of ciliated epithelium, which we have already considered, and which causes delicate currents towards the orifices of the mucous membranes on which it is placed.

The main property of muscle is its power of *contractility* under the influence of certain exciting agents or *stimuli*. There are two main kinds of muscle, those under the control of the will, and those entirely withdrawn from its control. These two kinds are known as *voluntary* and *involuntary* muscle; and as the former kind always presents transverse stripes, or striæ, it is also called *striped* or *striated muscle*; while the latter, not having these transverse striæ, is called unstriped or *unstriated* muscle. But we shall find that one kind of involuntary muscle (that of the heart) has transverse striæ.

Thus we have—

1. Voluntary or Striped Muscle.
2. Involuntary Muscle. { 1. Unstriped. 2. Striped.

Let us examine the structure of each of these in turn.

Voluntary muscular fibres are always connected into distinct masses or muscles of various sizes and shapes, running usually lengthwise along the limbs or trunk of the body, and fixed at their two ends to bone. Speaking generally, all men possess exactly the same number of muscles, and arranged in exactly the same way, however much they may differ in size.

The middle part of the muscle is often called its *belly*, especially if it is much thicker than the ends, as in the biceps muscle of the arm. The two ends of the muscle may become directly continuous with the periosteum of the two bones to which a muscle is

usually attached, the muscular tissue becoming fused with the fibrous tissue of the periosteum; or the muscle near its two ends may become *tendinous*, muscular tissue being replaced by white fibrous tissue, which forms a hard round cord or tendon, and this tendon is then fixed to the periosteum. The tendons round the wrist, and the hamstring tendons are common examples of the tendinous ending of muscles.

Every muscle consists of a number of distinct packets or bundles, called *fasciculi*, enclosed in delicate sheaths of connective tissue, by means of which they are at the same time connected with and separated from the other fasciculi in a muscle. This connective tissue also surrounds the whole muscle, and is sometimes called *perimysium*. The fasciculi are prismatic in shape, and when seen cut across (as in a piece of raw meat cut across the fibre) have, therefore, an angular outline. The length of the fasciculi varies; they may reach from one end of a muscle to another, or there may be a tendon inserted in the midst of a muscle, to each side of which fasciculi are attached.

When examined, the fasciculi are found to consist of a number of delicate *fibres*, running lengthwise in the bundles, having an average width of $\frac{1}{350} - \frac{1}{450}$ of an inch. These fibres themselves can easily be split up into a number of narrower *fibrils*, as seen in Fig. 26 at *a*. If a small piece of muscular fibre be

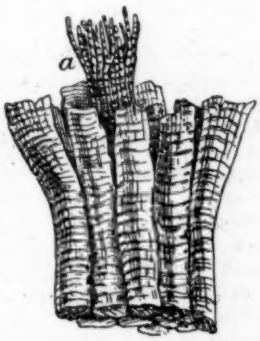


Fig. 26.—Part of a muscular Fasciculus, showing muscular Fibres highly magnified. (*a*.) A Fibre split up into its Fibrils.

teazed out, and then viewed under a high power of the microscope, the general substance of the fibres will appear translucent, but marked transversely with parallel dark bands, running across at regular intervals. These bands are of about the same width as the translucent intervals: hence we may speak of the muscle fibre as having dark and light stripes alternately.

Generally a fine dark dotted line can be seen running across the middle of the light stripe, and dividing it into two. The usual width of a dark or light stripe is $\frac{1}{1000}$ of an inch, but it varies considerably.

Each fibril in the fibres shows a similar transverse striation, and we may regard it as composed of a number of dark quadrangular particles, called *sarcous elements*, separated from each other by a bright space formed of some translucent material. Dr. Sharpey holds that each fibril consists of other more minute fibrils, so that the ultimate sarcous elements would not be quadrangular, but thread-like.

In addition to the general sheath of connective tissue sent in from the perimysium, each muscle fibre has a special sheath of its own, called the *sarcolemma*. This is a homogeneous membrane, resembling elastic tissue in the fact that it resists chemical agents; being tough, it sometimes remains entire when the included fibrils are ruptured by stretching the fibre, and so its existence can be demonstrated. It can be well seen in fishes or frogs, which have large fibres.

A considerable number of oval nuclei are visible in a muscular fibre, in mammalian muscles lying on the inner surface of the sarcolemma, but in frogs throughout the substance of the fibre.

As a rule muscular fibres do not divide or anastomose; but there are exceptions in the muscles of the tongue and face.

Blood-vessels run to each muscle in great abundance; they penetrate the fasciculi, and end in capillaries which run between the fibres, where they are arranged in oblong meshes (Fig. 27).

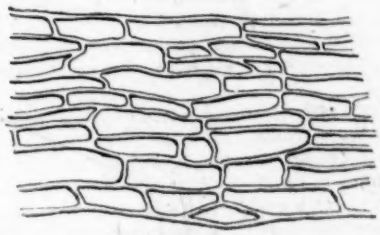


Fig. 27.—Capillary Vessels of Muscle, seen with low magnifying power.

Nerves are also supplied to all muscles, and by them stimuli from the central nervous system are brought. They pass between the fasciculi, uniting with one another in the form of a plexus or network, each nerve-fibre ultimately becoming connected with the sarcolemma of a muscular fibre.

Involuntary muscle is, as a rule, destitute of the transverse striation, which is a marked feature of voluntary muscle. In this form it is made up of cells, called *contractile fibre cells*, which are spindle-shaped and elongated, usually $\frac{1}{600}$ to $\frac{1}{300}$ of an inch long. Each presents a flattened rod-shaped nucleus near its middle. The fibre-cells are united to form fibres, and these into bundles of fibres. There is no distinct sheath like the sarcolemma of voluntary muscle.

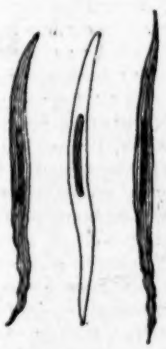


Fig. 28.—Fibre Cells of Involuntary Muscle from Human Artery. The middle one, treated with acetic acid, shows the nucleus more clearly. Magnified about 350 diameters.

Unstriped muscle is not found attached to bone s as striped muscle usually is (except in the heart and a

few other places). It is the muscle especially of organic life as opposed to that concerned in voluntary acts. Thus it forms the muscular coat of the digestive canal from the middle of the œsophagus to the anus, the muscular coat of the ureters and urinary bladder, the trachea and bronchi, ducts of glands, gall bladder, uterus, iris, and other parts. In the skin it lies between the papillæ, and when it contracts makes these specially prominent, so producing the phenomenon of goose skin (*cutis anserina*).

We said that involuntary muscle is occasionally of the striped variety. This is the fact in the case of the heart, the pharynx and upper part of œsophagus, the muscles of the internal ear and the urethra.

The heart-muscle differs in several respects from ordinary striped muscle. It presents the transverse striæ, but (1) they are less strongly marked and less regular than those of ordinary striped muscle; (2) it consists of distinct quadrangular cells, which often (3) present branched extremities; (4) each cell has an oval nucleus near its centre; (5) by means of the branched extremities the fibres freely anastomose.

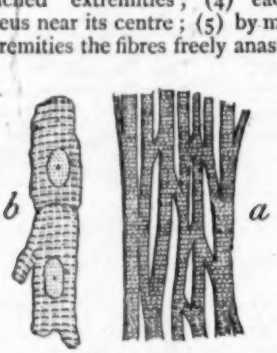


Fig. 29.—(a). Muscular fibres from Heart, magnified.
(b). Two muscular fibre-cells from Heart, more highly magnified.

Chemical Composition of Muscle.—When dried it loses about four-fifths of its weight; it contains about 74½ per cent. of water. The chief solid constituent is myosin, forming 15 per cent. At one time this was regarded as fibrin, but this is not correct. If a frog's muscle, obtained from the animal directly after killing it, be frozen and then rubbed up in a mortar with four times its weight of snow containing one per cent. of common salt, a semi-liquid mixture is obtained called *muscle-plasma*, which, when exposed to the ordinary temperature, becomes a solid jelly, separating into a clot and serum, just as blood does under similar circumstances. The clot is myosin, which, when mixed with dilute acids, forms syntonin, and with alkalies, alkali-albumen. It is very soluble in dilute saline solutions. Living muscle, it will be seen from the above experiment, contains no myosin, but some substances which bear the same relation to myosin, as we shall find fibrinogen and fibrinoplastin do to fibrin, and which become myosin on the death of the muscle.

Besides myosin dead muscle contains serum, albumen, and gelatin, each forming about 2 per cent. of the muscle; also fats in considerable quantity, and various *extractives*. By the word extractive is meant 'substances of varied origin and nature, occurring in small quantities, and therefore requiring to be extracted by special means.' The chief extractives are kreatin, sarcolactic acid, and sugar. Besides these there are xanthin, hypoxanthin, sarbin, inosit, and traces of uric acid. In living muscle there is frequently glycogen, which becomes sugar in dead muscle. Urea is conspicuously absent.

The ashes obtained by burning muscle show a very marked preponderance of potassium salts and of phosphates; in these respects resembling red blood corpuscles.

The above chemical constitution applies especially to striped muscle; but it is probably the same in unstriped muscle, and in fact it is probable that protoplasm (of which unstriped and striped muscle are modifications) possesses a similar chemical composition.

Physical properties.—The colour of muscle is a dull red made brighter by oxygen. Its specific gravity is 1064, blood being 1060. It possesses considerable elasticity, that is, power to return to its original form after traction or pressure; this elasticity is perfect within its own limits. By means of this elasticity force is, to some extent, economised. Dead muscles resist extension more powerfully, but do not afterwards return to their original length; hence their elasticity is less perfect than that of living muscle.

Vital properties.—These are sensibility and contractility, or irritability. They are called vital, as opposed to physical properties, because they are never manifested apart from a living organism.

Sensibility is not very acute in muscles, but is still of great importance. The sensibility belongs rather to the nerves coursing the muscle than to the muscle itself. It is sometimes called the *muscular sense*, and by means of it we are conscious of the position and relations of our limbs and other parts, and are able to guide our movements towards any desired end. Occasionally muscular sensibility is lost, while the power to move remains; then the person affected cannot walk in the dark, nor perform any muscular act without the guidance of his eyes.

Contractility or *irritability* is the power which a muscle possesses of shortening in obedience to stimuli. The stimulus causing contraction may be of various kinds. It may be applied directly to the muscular tissue itself, or to the nerve going to the muscle; the former stimulus is called *immediate*, the latter *remote*. Immediate stimuli may be *mechanical*, as when a muscle is struck; *chemical*, as by the application of salt, or ammonia, or an acid to the muscle; *electrical*, as when an interrupted current is passed through a muscle; or *thermal*, as when sudden heat (or cold) is applied to the muscle. Remote stimuli include several of the above, as when a galvanic current is passed along the nerve going to a muscle, or mechanical or thermal irritation causes reflex muscular contraction. In addition to these there are *central stimuli* originating in the will of the individual, or in the action of emotion, independently of the will.

The result of the application of any of these stimuli is the contraction of a muscle. When a single fibre is watched contracting under the microscope, the striæ are seen to approximate, and the fibre to shorten, and at the same time become wider. When excessive contraction occurs rupture of the fibre may occur, as in the disease called tetanus or lock-jaw.

In the heart we have an instance of muscular contraction occurring 60 to 70 times per minute, with intervals of muscular rest between. The only time when the muscle can be nourished is between the individual contractions. Unstriped fibres, when stimulated, contract in all directions, and the contraction, unlike that

in striped fibres, is not confined to the stimulated muscle, but is carried on to the muscles continuous with it. Thus we get the peristaltic movements of the intestines.

A muscular contraction, when caused by a momentary stimulus like that produced by the induction shock of an interrupted current, consists of three phases—first, a phase before any visible alteration in the muscle—the latent period, which is about $\frac{1}{11}$ sec.; second, the stage of contraction, lasting $\frac{1}{30}$ sec.; third, the stage of relaxation, lasting $\frac{1}{30}$ sec., during which the muscle is returning to its natural length. Of course, some of the latent period is occupied in the current passing along the nerve to the muscle. In man the rate at which a nervous impulse travels along a nerve is about 107 feet per second; the latent period of the muscle is about $\frac{1}{100}$ sec.

When the shocks given to a muscle are repeated with great rapidity, the muscular contractions resulting become fused into one continuous contraction, called *tetanus*, or *tetanic contraction*. This is a much com moner form of muscular contraction than the single muscular spasm. Even short movements, such as a sudden jerk of the arm, are really examples of tetanus of short duration.

The phenomena attending the process of contraction are at least five in number:—(1) Shortening and hardening; (2) sound; (3) electrical changes; (4) chemical changes; (5) development of heat.

A muscle in contracting becomes broader, shorter, and harder. There is no actual change in volume (according to Weber a very slight diminution), the increase in width equalling the diminution in length. This may be proved by placing two or three muscles freshly removed from a frog in a glass vessel full of water, with which a perpendicular glass tube communicates above. The muscles are connected with the poles of a battery, and are made to contract by passing a current through them. It is then found that the water does not rise or fall in the tube. The hardening is caused by the tension of the fibres.

Sound is produced by the tension of the fibres during contraction, and probably also by the friction. It is a low, rumbling sound, which may be heard, for instance, by placing the ear close to a person's bare arm, and then making his biceps muscle contract.

Electrical Disturbances.—If a piece of fresh muscle of a frog be taken and carefully cut at its two ends, and then the electrodes of a delicate galvanometer be connected with the longitudinal and cut surfaces respectively, there will be found to be an electric current from the middle of the muscle through the galvanometer to the cut end, or, in other words, there is positive electricity at the longitudinal surface, negative at the cut surface. A similar electric current, but not so powerful, occurs in a nerve removed from the body. When a muscular contraction occurs, the natural nerve-current undergoes what is known as a negative variation, the needle of the galvanometer swinging back towards zero, but returning to its previous deflection when the stimulus causing muscular contraction is removed.

Chemical Disturbances.—If a perfectly fresh muscle is washed free from blood (which is alkaline, and therefore a source of fallacy), it still shows an alkaline reaction. If it now be made to contract vigorously, it shows an acid reaction. The red colouration of litmus paper is permanent, and cannot therefore be due to carbonic acid, which is produced in considerable quantities during muscular contraction. It is probably due to sarcolactic acid.

The blood entering a muscle is arterial; when it leaves the muscle it is venous, the muscle having taken up oxygen and given out carbonic acid. The carbonic acid given out during muscular contraction is much greater than the oxygen brought by the blood. It is not derived from direct oxidation of any carbon compounds, but from the splitting up of more complex compounds. By continued muscular contraction the previous preponderance of watery extractives is changed for a preponderance of alcoholic extractives, that is, those requiring alcohol to dissolve them.

Heat is produced owing chiefly to the chemical changes occurring, but in part also to the friction involved. About 1° of heat is produced by each forcible contraction of a man's biceps. But after a prolonged rest, diminution of heat is produced on the first contraction of a muscle, owing to the heat of the muscle being converted into mechanical force.

The different electrical, chemical, thermal, and mechanical results of a muscular contraction are exactly correlative of each other. Starting with an assumed electric stimulus entering a muscle; this causes the mechanical movement involved in the contraction of the muscle. The muscle requires chemical action to keep it in a responsive condition to the stimuli imparted; and this chemical action produces heat.

Conditions affecting contractility of Muscles. (1) *Nutrition.*—Anything interfering with blood supply, or rendering the blood supply impure, diminishes contractility. Death cutting off blood supply entirely, soon puts an end to contraction.

(2) *Disuse.*—If a limb be fastened up in any position, its muscles become wasted and weaker. The contractility may be restored if complete wasting has not occurred. Electricity sets up contraction, and it is in this way chiefly that it improves nutrition.

(3) *Over-use* may produce the same effects as disuse, especially when there are no intervals of rest. The usual effect of large use of a muscle is that its nutrition and bulk increase, if proper intervals of quiet are allowed.

(4) *Nervous Disease.*—If the nerve supply be cut off from a limb, all voluntary power of movement is lost, but for some time the muscles will contract if a stimulus be applied directly to them. After a time the muscles waste, and often very rapidly, the nervous system having a very important control over nutrition; then the muscles cease to respond to stimuli.

Condition of Muscles after Death.—We saw that myosin exists in living muscle in a liquid condition. At a variable period after death it solidifies, and when this process is complete, muscular contractility ceases, and the condition known as *rigor mortis* supervenes. After a time this rigidity ceases, and a condition of relaxation follows, in which there is still an absence of muscular contractility, to be followed too soon by putrefactive changes.

There are thus three stages after death:—(1) *Irritability.*—Capacity for contraction under stimulation. (2) *Rigor mortis.*—Muscles stiff and irritability lost. (3) *Relaxation.*—Muscles lax, but no irritability.

We may regard irritability as a continuance of the living condition in the muscles. As *rigor mortis* sets in, the muscle becomes more opaque, is rigid and in-

elastic; the normal muscle currents cease; while the muscle becomes acid, there is an increased production of carbonic acid, and a rise of temperature, owing probably to a final muscular contraction at the onset of *rigor mortis*.

The duration of irritability after death varies from a few seconds to eight or ten hours. It is generally nearer the latter time in man. It is shorter in birds than any other animals. It is longer in the young and vigorous than in the old. In those who have died of wasting diseases, as fevers or consumption, it is only one-third as long as in those who die suddenly. Exhaustion in general before death shortens the period; thus, where death has resulted from a small dose of strychnia it is very short, owing to the severe and continued spasms produced. In cold weather it is shorter than in warm. In small animals it is much shorter than in large animals. The duration of irritability varies in different muscles in the same individual. Thus in man, the left auricle, which has had during life the freest supply of oxygenised blood of any part of the body, has the shortest period of irritability, while the right ventricle has the longest period.

Rigor mortis usually begins eight to twelve hours after death, and lasts from eight to thirty-six hours. Its duration is affected by circumstances similar to those affecting the duration of irritability. It may be regarded as the last act of life, so far as the muscles are concerned, being accompanied by the chemical and other changes already named. It was formerly supposed to be due to the coagulation of the blood in the muscles, but although this, doubtless, occurs, the real cause is the coagulation of the myosin.

A condition of *rigor mortis* may be set up in any muscle by stopping its blood supply. If the stoppage has not been too long continued, the rigidity disappears when warm blood is injected into the muscle.

Post-mortem rigidity does not affect all the muscles simultaneously, but usually in a regular succession. Thus the neck and the lower jaw are affected first, the lower jaw becoming raised instead of the previous dropping; next, the muscles of the trunk; then the arms, followed by the legs. It usually disappears in the same order of succession. Involuntary muscles are affected in the same way. The muscular fibres of the arteries contract and force the blood in them on into the veins; in consequence of this, they are always found empty after death, and as they were supposed by old anatomists to contain air, or animal spirits, they were called arteries (*arteria*, an air-vessel).

With the cessation of *rigor mortis*, the muscles relax, become alkaline in reaction, are incapable of responding to stimuli, and speedily decompose.

(*To be continued.*)

Anecdotal Natural History.

BY THE REV. J. G. WOOD, M.A., F.L.S.,
Author of 'Homes without Hands,' 'Nature's Teachings,' etc.,
AND THEODORE WOOD,
Joint Author of 'The Field Naturalist's Handbook.'

No. XXV.—THE HYÆNAS.

THERE are few greater contradictions in nature than that afforded by the HYÆNAS, which, although possessed of activity and of almost marvellous strength, yet lack the courage which would enable them to make efficient use of their powers.

No hyæna, for example, would venture upon attacking a knee-haltered horse, simply because the animal, though unable to run away, would face its cowardly foe. And yet the hyæna would be far more than a match for the horse, and could drag it to the ground with the greatest ease could it only summon sufficient courage and resolution to enter upon open attack.

It thus often happens that, out of a herd of cattle, the strong and healthy animals fall victims to the hyænas, because they take to flight, while the weak and sickly ones, which cannot run away, face their foes with the courage of despair, and so remain unmolested.

The same is the case with wild animals. Provided that they can be induced to take to flight, the hyænas will attack them and drag them to the ground, partly by sheer strength and partly by the pain of the wounds which they inflict upon their flanks. But any animal which dares to face them is absolutely safe from their attacks, and may bid defiance to almost any number of its enemies.

In so great contempt do the Arabs hold the hyæna, on account of its cowardly nature, that they scorn to use any weapon in order to bring about its capture, and destroy it in the following manner.

Having driven the animal to bay in some cave, or other retreat, from which there is but one outlet, they boldly enter, taking with them nothing but a handful of mud. Having advanced to within a few feet of the animal, they dash the mud into its eyes, drag it from its retreat, and muzzle it before it has had time to recover from its bewilderment. This done the warriors, who consider it beneath their dignity to slay so contemptible an animal, hand it over to the women and children, who straightway stone it to death.

Throughout Africa, also, the hyæna is regarded with the same contempt, any weapon which has been employed in its slaughter being considered as defiled, and unworthy to be again used in the chase of nobler quarry, and much less in war.

In districts where the hyænas are abundant the flocks of the settlers are sure to suffer severely, the cunning animals being almost certain to find their way into the folds, no matter what precautions may be adopted to keep them outside. Once having effected an entrance, they very seldom fail to obtain a meal, for they are almost sure to find some cow which, more timid than her fellows, takes to flight at the appearance of her foes, and so seals her own fate. For it but seldom happens that an animal, when once fairly attacked by hyænas, contrives to escape, although cattle may now and then be seen whose scarred flanks testify to unusual good-fortune in this respect.

Nor do the herds alone suffer.

It occasionally happens that a hyæna, having once, probably by accident, tasted human flesh, becomes a confirmed man-eater, and, like the lion or tiger under similar circumstances, no longer cares for any other diet. His taste, however, is not always easy to gratify, for his cowardly nature prevents him from attacking even an unarmed man, far less the accoutred warriors whom he is much more likely to meet. He therefore hangs about the settlements under cover of night, and, by the exercise of his unequalled craft and subtlety, sometimes contrives to take a sleeping babe from its mother's arms without awakening either parent or child.

So dangerous an animal is naturally persecuted to a great degree in every district which it inhabits, and

traps without number are set in order to compass its destruction. Of these, the spring-gun is that most usually adopted, the bait being generally a piece of raw meat fastened in such a manner that its removal discharges the contents of the weapon into the heart of the marauder.

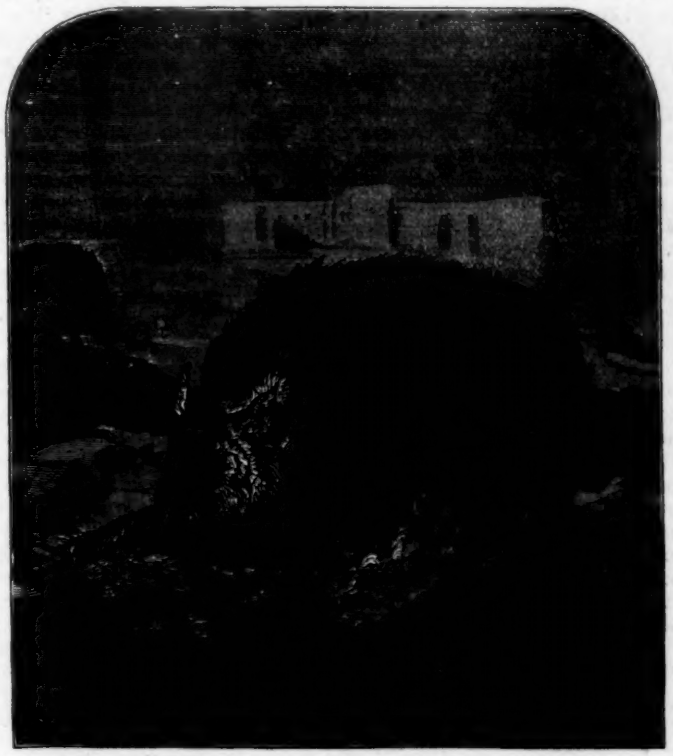
Simple though the principle of this trap may be, it has yet to be constructed with unusual care, for the caution of the hyæna is so great that it takes the alarm at sight of anything in the form of string. The slender stem of some creeping plant is thus generally employed in the place of cord, as it awakens no suspicion in the mind of the wary animal.

Unpleasant though the hyæna may be in many respects, it is nevertheless a most useful animal in others, for it acts the part of a scavenger in removing putrid animal matter—a task especially necessary in the hot countries which it inhabits.

There is no offal, however repulsive, which will not afford a meal to the hyæna, whose appetite seems literally insatiable, and whose stomach is capable of digesting such substances as even the toughest leather. Its mighty jaws are endowed with power so tremendous that even the leg-bone of an ox is crushed by them apparently without an effort, while the hide of the buffalo itself is devoured by the animal with perfect ease.

In order to procure its meals with as little trouble to itself as possible, the hyæna is much given to dogging the steps of the larger animals of prey, such as the lion, in hopes of securing the remains of their victims. It occasionally happens, however, according to common report, that the voracity of the hyæna overcomes its discretion, and impels it to commence its meal before the true owner of the flesh has fully satisfied his requirements. In such cases it is said, although with what truth it is uncertain, that the lion punishes the impatient animal by biting off its paws, thus condemning it to a painful and lingering death. Whether this be the case or not it is naturally somewhat difficult to ascertain, but as hyænas have been occasionally found mutilated in the manner described, there would seem to be a certain element of truth in the story.

It is a curious fact that almost the entire strength of the hyæna seems to be concentrated into the head and the fore-quarters, the hinder parts being almost insignificant in comparison. This disparity is noticeable even in the form of the animal, the fore and hinder parts seeming almost to belong to different beings.



Among the mammalia, we find in the Mole the maximum of power in the fore part of the body, with the minimum of force in the hind limbs, simply because the fore-limbs are intended for digging, and the hind limbs for progression alone. Indeed, the mole, like the hyæna, appears to be composed of two animals, a powerful one in front and a weak one behind.

The same rule holds good even in the insects. The Mole Cricket, for example, has the front part of the body enormously developed; the 'pro-thorax,' which contains the muscles of the front legs, extending far underneath the body, and so giving the needful space for their attachment.

A somewhat similar construction is found even in such insects as the Dor-beetle, whose eggs are deposited in burrows deep beneath the surface of the ground. The difference in the hyæna is so marked that the shoulders of the fore-legs, which are largely

used for digging purposes, are raised several inches above the hips, the back of the animal thus sloping considerably from the head towards the tail.

This disproportion in the size of the limbs causes the hyæna to assume a peculiarly awkward and shambling gait, difficult to be described, and very characteristic of the animal. It can, nevertheless, travel at a considerable speed if necessary, its short legs carrying it over the ground with wonderful rapidity.

The structure of the skull at once reveals to the practised anatomist the marvellous power of the muscles of that region. The bony arches extending from the eyes to the ears are of wonderful strength and thickness, while a high ridge of bone runs along the top of the head, and serves as an attachment for the mighty muscles to which the animal owes its strength.

The reader must always bear in mind that in Nature nothing is made in vain, and that every groove and ridge upon a bone tells its story to the anatomist.

Suppose that we contrast the skull of a man with that of a gorilla, or hyæna, we find at once that the skull of man is quite smooth, while in the gorilla and hyæna there is this boldly-projecting ridge which has been mentioned. The position and size of the ridge show that it is intended for the attachment of the extremely powerful muscles which work the lower jaw.

Therefore, the jaw itself must be correspondingly strong, and fitted with teeth which render such an apparatus necessary. We are, however, met by one problem. The gorilla is essentially a vegetarian in diet, while the hyæna is as essentially carnivorous, and yet we find that each creature possesses jaws of tremendous power. The fact is, that the gorilla feeds largely on the cocoa-nut, and his teeth and jaws enable him to tear the tough husk asunder and then break the hard shell.

The hyæna, however, being one of the largest of Nature's scavengers, is furnished with jaws and teeth which enable it to do what we may call the rough work.

Suppose, for example, that a camel sinks under its burden and dies. Scarcely is the breath out of it, when the vultures descend upon it, and tear the flesh from its bones. Then come the blow-flies, and the myriads of carrion-eating beetles, so that in a wonderfully short time nothing is left except the skeleton.

But even this bony framework is not permitted to cumber the earth, and so the hyæna is appointed to the task of removing it. No bone seems to be too strong for the hyæna's jaws. I have often given the creatures the leg-bones of horses and oxen, and have never known one which did not yield before the power of the hyæna's jaws. At each bite the bones explode like pistol-shots, and the splinters fly in all directions.

Proverbially we speak of 'dry bones' as the emblems of everything that is uninteresting.

To the comparative anatomist nothing is so full of interest as a dry bone which he has not seen before. To what kind of vertebrate animal must it belong? The tiniest fragment will tell by means of the microscope whether it be the bone of a mammal, a bird, a reptile, or a fish. But then, what part of the animal did it represent? What is the meaning of a groove here and a ridge there? Why should there be a rounded projection (called scientifically a 'condyle') where it could not be expected?

These questions are, in fact, a series of enigmas, and nothing can be more interesting than their solution. A ridge, for example, means the attachment of one end of a muscle. Where must the other end be, and what has it to do? A groove signifies a tendon. Why was that tendon there, and what work had it to fulfil? And so, by successive steps in reasoning, the comparative anatomist can reconstruct with absolute accuracy an animal which he has never seen. The reader may perhaps recollect that several of the great fossil animals in the grounds of the Crystal Palace were only constructed on conjecture; they have since been proved to be accurate even to the minutest details.

The tongue of the hyæna is formed like that of the animals of the cat tribe, being studded with innumerable sharp points, which serve to rasp every particle of flesh from the bones of its victims. This provision, however, seems almost superfluous when we take into consideration the fact that the bones themselves are invariably devoured by the animal, so that it can make but little difference whether the flesh is swallowed separately, or while still adhering to them.

The paws of the hyæna are similar in structure to those of the members of the dog family, the claws not being retractile, as is the case with the cats. The 'spoor' of the two animals, however, is so different, that the footmarks of the one can by no possibility be mistaken for those of the other.

THREE species of hyæna are recognised, the first of which is the Striped Hyæna (*Hyæna striata*), which may be at once distinguished by the blackish stripes upon the sides of the body and the limbs. A large black patch adorns the front of the throat, and the fur of the whole body is tolerably closely sprinkled with blackish hairs. The general colour of the fur is a greyish-brown. In the young animal the fur is of a lighter hue, and the dark markings are more apparent than in the adult.

The striped hyæna is a native of Syria, Persia, and the northern parts of Africa, where it is generally found in considerable abundance. A curious superstition is attached to it in Palestine, the animal being thought to possess the power of fascinating the solitary traveller, and causing him to follow it to a secluded spot, where he is set upon and killed by his treacherous guide. The presence of a second person, however, is supposed to neutralize the charm, so that a traveller is often warned, should he fall in with a hyæna, to at once shout for aid, in order that the arrival of a new comer may liberate him from the wiles of the hungry animal.

Not only on account of its supposed supernatural powers, but also from its habit of rifling the graveyards, the hyæna is regarded with peculiar abhorrence in Palestine. The tombs of the rich are seldom interfered with, for they are generally cut out of the solid rock, and closed by means of a large and weighty stone placed against the entrance. Those of the poorer classes, however, are graves in the ordinary acceptation of the word, and are usually covered with heavy stones in order to protect them from the excavatory powers of the hyænas. Unless great care be taken, however, this precaution is in vain, for if any crevice be left the hungry animals will enlarge it until they are able to reach the corpse and drag it from its resting-place.

In spite of this propensity, nevertheless, the health of the inhabitants of various Eastern countries depends largely upon the hyænas, for, with characteristic thoughtlessness, the natives are in the habit of throwing garbage of all sorts into the streets, and so expos

ing themselves to the many evils resulting from the influence of miasmatic vapour. The hyænas, however, with their insatiable appetites, venture into the towns after nightfall, and perform the scavenger's part in removing the offensive refuse.

The comprehensive nature of the diet of these animals is really wonderful. Nothing seems to come amiss to a hungry hyæna, from a newly-born lamb to strips of hippopotamus hide, and even a pair of stout leather boots will furnish him with a very satisfactory meal. To a creature with such marvellous powers of digestion, the mastication of food appears wholly unnecessary, and the hyæna will swallow huge pieces of bone and gristle without the slightest preparation of any kind.

THE habits of the Brown Hyæna (*Crocuta brunnea*) are so similar to those of the striped hyæna, or strand wolf, as it is often called, that it needs no separate description. The third species, however, namely, the Tiger Wolf, or Spotted Hyæna (*Crocuta maculata*), differs in several respects from the preceding animals.

This animal is perhaps more generally known by the title of the Laughing Hyæna, on account of the hysterical fiend-like sounds to which it gives vent when excited in any way. At such times the animal seems literally beside itself, dancing frantically upon its hinder legs, running wildly backwards and forwards, and performing the most ridiculous antics during the continuance of the paroxysm.

In olden times the tiger wolf was thought to utter these remarkable cries with the view of luring men to destruction, by imitating the sounds of human revelry, and so tempting passers-by to join in the feast.

The tiger wolf is perhaps the most ferocious and the least cowardly of the hyænas, although it will seldom venture upon open attack with any but a particularly insignificant foe. Even when its intended prey has taken to flight, too, the hyæna takes the greatest care to spring only upon its flanks, where it is secure from any possible wounds from teeth, claws, or hoofs. Yet it is possessed of sufficient courage to enter houses after nightfall, and carry off adult men and women—provided only that they happen to be asleep—whereas the preceding animals seldom venture to interfere with any but the infants.

The hyæna is the more dangerous in this respect, in that he is not deterred from making his attack by the camp fires, which effectually keep all other beasts of prey at a distance, creeping between them, and not seeming to entertain the slightest dread of the flames.

With customary caution, the tiger wolf conceals itself by day in holes and crevices in the rocks, where its presence can generally be detected by the rank and offensive smell which is a characteristic of the animal. Dogs appear to entertain the strongest objection to this odour, and will fly from the track of a hyæna with every mark of fear. This reluctance to follow the trail of the hyæna can scarcely be due to any dread of the creature, for the same dogs will attack far bolder and more powerful animals without the slightest hesitation, but must be owing to some peculiarly offensive property of the scent.

The tiger wolf is a much larger and more strongly-built animal than either the striped or the brown hyæna, and may be distinguished at a glance from either of those species by the spots which are scattered over the body and limbs. These spots are more distinct upon the legs than upon the back or sides, and are set more closely together. The ground colour of the fur is a reddish brown.

Animals with dispositions so fierce, yet cowardly and sullen, as that possessed by the hyænas are little amenable to kindness, and are, therefore, well-nigh untameable. Cases have been known, however, in which hyænas have become tame, and have learnt to follow their masters and do their bidding just as would a pet dog.

CLOSELY related to the hyænas, although more properly belonging to the family of the Civets, the Aard Wolf of Southern Africa (*Proteles cristatus*) deserves a few words of mention.

This animal clearly forms the connecting link between the two families, the highly developed muscular system of the fore quarters, the sloping back, and the character of the fur showing its relationship to the hyænas, while the structure of the feet and other parts of the body prove its affinity to the civets. It is a much smaller animal than any of the preceding, being about the size of the common Jackal.

As is the case with the hyænas, the fore paws of the aard wolf are formed for digging purposes, and can be used by the animal with wonderful effect in the excavation of its burrows. A rather curious plan is adopted by these animals, a number generally making their burrows in the immediate neighbourhood of one another, and causing the tunnels to converge to a common centre, where a tolerably large cavity is hollowed out. This chamber seems to be used by all the animals alike, each, however, possessing the right of way through his own burrow only.

The aard wolf is another of Nature's scavengers, feeding largely upon carrion and other putrid substances. It is equally fond of living prey, however, various small animals falling occasional victims to its prowess, while it does not disdain a meal upon certain insects, such as ants, numbers of which have occasionally been found in the stomach of a slain specimen.

The general colour of the fur of the aard wolf is a yellowish-grey, several broad bands of a darker hue running horizontally upon the sides. The paws also are quite black. The tail is remarkably bushy, the hair being black at the extremity, and blackish-grey upon the remaining portion. But for this tail the animal has rather the appearance of a small specimen of the striped hyæna.

The title of 'Aard' wolf, or 'Earth' wolf, which has been applied to the animal, relates to its fondness for digging in the earth; the well-known Aard-Vark of the same part of the world received its name for a similar reason.

Notes on Bacon's Essays.

BY FRANCIS WATT, M.A.

ESSAY XLVII.—OF NEGOTIATING.

SUBSTANCE.

NEGOTIATIONS are, as a rule, better managed by speech or messenger than by letters. General principles laid down for the conduct of negotiations.

may be danger to be interrupted, there may be danger of being interrupted.
breedeth regard, causes respect.
tender, delicate.
help the matter in report for satisfaction sake, make the thing more agreeable than it really is to please their employer and make him contented with them. Note satisfaction for satisfaction's; the *s* is elided because the next word begins with *s*.
affect, has an inclination for.
forward and absurd, imprudent and unreasonable men.
prescription, prestige, reputation: in law a right acquired by undisputed possession.
it is better, etc., to beat about the bush as we say, so Hamlet, 'by indirections find directions out.'
fall upon the point, to come to the point.
short question, direct and pointed demand.
in appetite, not having what they desire, but eager for it.
if a man deal with another, etc., if a man is engaged in arranging a compact with another, which compact is to be binding upon both parties, the great point is who shall first begin the fulfilment of the conditions. One can only ask the other to begin if the circumstances of the case render it reasonable that he should do so, or it is his interest to begin, or that he ought to begin since the other is reputed the more honest.
practice, negotiating with a notion of cunning. Cp. 'King John':

> 'It is the shameful work of Hubert's hand,
> The practice and the purpose of the King.'

to discover or to work, to find out something or to do something.
in trust, when revealing their inclinations.
work any man, influence him.
fashions, build of his mind.
interest in him, connected with him in bonds of interest.

ESSAY XLVIII.—OF FOLLOWERS AND FRIENDS.

Substance.

Of followers, those who are costly, have extravagant expectations, are factious, or boastful, or carry tales, are to be avoided. Those who are of the same calling as their patrons, are plausible, or suited for any special business in hand, are to be chosen. Some general rules for the employment of followers. Our friends should be few. True friendship is not common among equals.

his train larger, a man cannot rise if encumbered with many followers.
charge the purse, are directly expensive.
importune, importunate.
challenge no higher conditions, demand no greater favours.
countenance and recommendation, a reasonable amount of personal favour used on their behalf.
worse to be liked, less to be liked.
which, now we should use *who*. Cp. 'Our Father which art in heaven.'
upon, on account of.
ill intelligence, bad feeling.
glorious, boastful (L. *gloriosus*).
of, for.
taint business, spoil the management of affairs.
export honour from a man and make him a return in envy, cause him to be dishonoured and envied.
espials, spies.
officious, eager to serve.
estates, classes.
answerably, corresponding.
civil, becoming, proper—for soldiers to join themselves as followers to a great soldier is not improper.
apprehendeth to advance, strives or is eager to advance.
eminent odds, great disparity.
to take with, to be connected with.
passable, popular, well received.
equally, in the same manner.
discontent, discontented.
claim a due, what others in the same rank get they will claim as a right.
contrariwise, on the other hand.
election, selection.
more officious, ready to serve as hoping for promotion.
hold out that proportion, keep it up.
governed, completely influenced and controlled.
softness, weakness.
gives a freedom, gives opportunity for.
censure, judge. So in 'Julius Cæsar,' 'Censure me in your wisdom.'
with them, Bacon has just said *a man*; but the meaning is plural.
distracted, dragged in different ways (L. *dis*, apart, *traho*, I draw).
last impression, the thing he has most lately heard. So the proverb says of a weak man, 'The last fool has him.'
lookers on; so the proverb, 'Lookers-on see most of the game.' They are not interested, and therefore most clear-sighted.
the vale best discovereth the hill, we see hills best, not when we are standing on them, but from the valley beneath.
wont to be magnified, the advantages and pleasures of friendship, and cases of friendship, were favourite subjects of disquisition among the classic writers.
comprehend, enclose.

ESSAY XLIX.—OF SUITORS.

Substance.

Suits proper and improper. Rules laid down for those who consider suits, and principles stated which they who are petitioners or suitors ought to follow.

ill matters, mischievous matters.
private suits do putrefy the public good, the desires and efforts of individuals frequently seek what it is not for the public advantage to grant.
embrace, profess to aid.
deal effectually in, aid in reality.
life in the matter, by some other mean probability of success, on some other account.
second reward, some sort of recompense, though they do not get the best.
cross, disappoint, hinder.
make an information, come forward to state certain matters.
entertainment, excuse side means.
some sort a right in every suit, every suit admits of being justly decided on.
a suit of controversy, a dispute between two parties.

a right of dessert, if it be a suit of petition, if something is asked, and no one appears, then we ask does the petitioner deserve that his request be granted.

countenance, favour, influence.

compound the matter, rather to make the quarrel up between the two parties than to give it in favour of one.

depraving or disabling, defaming or hurting.

referendaries, referees (*L. re*, and *fero*, I carry), men of special knowledge to whom a matter is referred.

distasted, disgusted.

to deal in suits, to have anything to do with suits.

barely, exactly as it is.

challenging, demanding,

gracious, meriting thanks.

first coming ought to take little place, the mere fact that a man is first in pressing his suit ought not to count for much.

so far forth, to this degree.

note, information thus obtained.

means, resources.

discovery, the revelation of private matters that he has made.

voicing them to be in forwardness, openingly asserting that they are progressing well.

timing of the suit, knowing when to present it: urge it not only when those on whom it depends are favourable; but when the hostile parties are absent or in disfavour.

mean, advocate or instrument.

them, the pronoun is plural, though it refers to a singular noun.

deal in special things, and specialists rather than those who have only a general knowledge.

Reparation of a denial, some kindness may be shown to make up for the refusal, and this is perhaps equal to the granted suit.

Iniquum petas, etc. 'Ask too much, and get your due.'

a man were better. It were better for a man; *man* is thus objective, so in 'As You Like It': 'You were better speak first' = It would be better for you to speak first.

rise in his suit, increase his demands.

conclusion, result.

so easy a request, so small a favour.

so much out of his reputation, it does him harm to have used his influence in a bad cause.

general contrivers, promoters of all suits, no matter what they are.

ESSAY L.—OF STUDIES.

Substance.

The use and abuse of studies commented on. Rules given to guide us in study. The various infirmities of the mind are cured by intellectual remedies appropriate to them.

for ability, they increase our ability.

privateness and retiring, privacy and retirement.

discourse, rational conversation.

disposition, arrangement, management.

expert (*L. experior*, I try), skilled in the business, practical men.

the plots and marshalling of affairs, scheming and arranging business.

come best from, is best done by.

sloth. Bacon makes us observe that studies are *means* not *ends.*

affectation, conceit, love of display.

to make judgment, to form our judgment.

humour of a scholar, temper of mind of a pedant; so Sir P. Sidney:—

> 'There came a young lord, led with the humour of youth.'

nature, our natural disposition.

too much at large, too general, or wide of the mark.

simple, uneducated.

admire, wonder at (*L. admiror*, I wonder at).

use them, turn them to practical account.

without them, outside of them.

contradict and confute, to *contradict* a statement is to deny it, to *confute* it is to prove its untenableness by arguments.

In no part of Bacon's essays is his wonderful power of brief, pithy expression seen at greater advantage than in what follows.

curiously (*L. cura*, care), carefully, minutely; so in 'Hamlet,' 'Twere to consider it too curiously.'

extracts, abstracts, or summaries.

would be, for should be.

arguments, topics, subjects.

distilled books, summaries and abstracts of books.

flashy, with some show, but no real worth. The present day slang use of flash and flashy is almost the same as Bacon's. Cp. also 'Lycidas':—

> 'When they list, their lean and *flashy* songs
> Grate on their scrannel pipes of wretched straw.'

full, well informed.

conference, discussion, mixing much with men.

present wit, quickness of mind.

subtle, acute.

rhetoric, the art of the orator.

abeunt studia, 'studies influence our characters,' from Ovid.

stond, hindrance.

wrought out, gradually removed.

bowling, with balls on a green. A very favourite game at present in Scotland, and then in England.

reins, the loins.

shooting, with bow and arrow.

wandering. Bacon says in another place, 'If he be bird-witted, that is, hath not the faculty of attention.'

if his wit be called away, if his mind wanders.

schoolmen, 'so called from the *schools* opened by Charles the Great for the promotion of speculative studies. They were mostly clerics; their writings are wholly logical and metaphysical. Aristotle was their acknowledged master. The best known are Abelard, Thomas Aquinas, and Scotus Erigena.' As noted in the text, they were famed for the discussion of knotty, and often trifling questions.

Cymini sectores, splitters of cummin-seeds, hair splitters.

beat over, to sift, and examine thoroughly.

lawyers' cases, decisions of the courts. We still speak of case law.

Lessons in English.

BY ALEXANDER BAIN, LL.D.,
Author of "Education as a Science."

I.—The Definition of Poetry.

The most obvious way to arrive at the definition of a general name is to survey the individual things denoted by the name; to compare them one with another, and to find out the points wherein they all agree. This would be the way to obtain the definition of a metal, of a planet, of a bird, of a savage, of force, of law.

Every one cognizant of the incidents that attend the defining process is aware of one difficulty, not unfrequent, namely, that a comparison of the things that have received the name in current speech reveals scarcely any great or important attributes inhering in them all. In fact, from well-understood causes, a name is sometimes so loosely applied as to swamp the agreements that we should expect to find under it. The word "Nature" is an example of this careless employment.

The term "Poetry" is an example of the same kind. It has been scattered with such profuseness over the field of literature, that we are at a loss to find any community at all, still less a number of points of community, at once large and important. Yet, without some prevailing peculiarity, or peculiarities, and these of considerable significance, the notion, when got at, is worthless and illusory, and the name a superfluity or else a snare.

There is often a peculiar incisiveness in defining by Negation; in stating what a thing *is not*. In dealing with the word "Nature," we find a great approach to clearness by negative attributes, "not Art," "not artificial," "not acquirement or education," and so on.

The method has been applied to poetry and has yielded the most precise of the definitions that have obtained currency. Yet such is the subtlety and the slipperiness of the notion, that it has, in a measure, evaded even this powerful application.

The Old Logic gives us the method of defining *per genus et differentiam;* which is very well, provided the exact genus is known and agreed upon; as, when we say that a church is a *building*, or that botany is a *science*. Poetry ought, I believe, to rank under the genus Fine Art, but evidently this is not allowed, if we may judge from the fact that it is scarcely ever adduced in the course of the many attempts at defining. Then, again, Fine Art itself is not clearly circumscribed; it repeats in the genus the very difficulties that belong to the species.

There are a few terms that may be looked upon as synonyms of Poetry to this extent, that their definition is settled, if it is settled. One I have just mentioned, namely, Art in general. Others are Beauty, Genius, Imagination, Ideality. If these could be all independently cleared up, Poetry would follow them at no great distance. *Vice versâ*, when it is defined, so will they be.

The difficulty of the case is farther ascribable to the want of prior definitions of the constituents that are always made to enter into the notion. As being a highly complex notion, it must be defined by stating its component parts; but we shall presently see that the words commonly used for this purpose are the names of very vague ideas.

Farther, the notions that Poetry comes into contact with, partly through common participation, partly through contrast, are themselves wanting in precision; indeed, some of them depend greatly upon a clear understanding of the meaning of poetry. Thus it certainly comes into contact with Pleasure in some shape or other; also with Morality; with Nature; most of all with Religion. Then again, it frequently overlaps the field of Eloquence, and the two are very difficult to dis entangle. Poetry often passes into Eloquence, and Eloquence is often heightened by Poetry; yet this is no reason why each should not have its own proper field, well marked out. The most useful forms of the metals are alloys; yet the chemist takes care to state the properties of the constituents in their purity; while he does not insist on calling brass, or bronze, copper. So there should be something typical of Poetry in its purest form; even although the majority of Poems may not adhere to the type. There may be good reasons for not adhering, in a composition of some length, to any unmixed style; nevertheless, the fact of mixture is apt to be misleading. Pope probably considered that all he wrote was alike poetry.

Of all the subjects touching upon Poetry, whether by likeness, or by contrast, the most manageable is Science. Science admits of a clear definition in itself; it is one of the chief contrasts of Poetry, and the occasional mixture of the two is the least puzzling of any of the mixtures. Poetry sometimes takes up scientific generalities, as in the hands of Tennyson; and Science is occasionally made to appear poetical; but the respective characters of the two departments are never confounded beyond the possibility of separation. If it were as easy to disentangle the complications of Poetry with Eloquence, we should be much nearer the desired solution.

The contrast of Poetry with the other Fine Arts is very easy to assign, when we have settled the generic idea of Art.

The more popular contrast of Poetry with Prose has I think been made sufficiently plain in the course of the many discussions that have taken place among critics.

If the task of defining is so difficult in this case, why may we not leave it alone? What is to be got by it, even if we were to succeed? A rather important question, admitting of two answers—general and particular. The general answer would be to show the importance of precise definitions of all leading words. If a term conveys approbation, or the opposite, justice requires that its employment should be not vague but precise. It is a great compliment to call a man generous: but if you do not apply the word so as to discriminate exactly the good quality meant by it; if you apply it to people that give away what does not belong to them, or what they should spend upon their own families, you misapply it to the extent of confounding good and evil.

But of Poetry in particular, the reasons for exactness in the definition are very strong. The subject is one of vast magnitude; it has occupied the labours of many of the most gifted of mankind; and has exercised incalculable influence upon human conduct. The effects have not been unmixed; sometimes it has been positively perverting and noxious; at other times it has failed to do all the good it might do. Moreover, its pretensions are often enormous. The poet is frequently described as inspired; as a revealer of truth; a spiritual guide, a light in darkness, and a

consolation in misery. Such pretensions necessarily provoke scrutiny; but in order to such scrutiny we must first settle the province of poetry.

Let us then begin by adverting to some of the various attempts to deal with the question. Most of the existing definitions contain an element of the truth; it is easy to go so far; it is less easy to get the whole truth, and nothing but the truth.

Thus the definition given by Aristotle in his Art of Poetry, namely, an Imitative Art, is a part of the truth. It appertains to Poetry, in common with other Fine Arts, but it does not apply to the whole of the Arts, nor to all Poetry. Its deficiencies are supplemented so far by the Baconian definition, which is also very Wordsworthian; this starts from effusiveness, phantasy, the outpouring from within, as opposed to copying or derivation from without. Wordsworth, in his Preface to Lyrical Ballads, says, "Poetry is the spontaneous overflow of powerful feelings." Now both modes of defining—by Imitation and by Effusion—are applicable to the subject, but both must be qualified or conditioned, in order to their being applied with the requisite degree of closeness. There are unpoetic imitations and unpoetic outpourings; so that the quality that we are in quest of, is not yet given in its simpleness or purity.

Of more modern definitions, the "interpretation of nature" has been received with favour. The poet reads or interprets meanings in the face of nature that the unpoetic mind cannot discover. Thus of Peter Bell it is said—

> A primrose by a river's brim
> A yellow primrose was to him,
> And it was nothing more.

Now the fact must be allowed; but "interpreting" is not, in my judgment, nor in the view of many critics, the proper word. The poet does not evoke, but *adds on*; he combines with the naked appearance something extraneous whereby he can impart new interest. He *assimilates* a mountain, a rock, a waterfall, a tree, a flower, with some aspect of humanity, charged with emotion:—the mountain, the rock, the waterfall, with energy or strength; the flower with tender feeling, the tree with one or both; and thus provokes a certain outburst of these emotions. In no proper meaning can such emotions be said to be wrapt up in the objects themselves.

Let us, for the sake of an illustrative view, borrow the Platonic theory of Creation by a mediate power or personage, whom Plato calls the Demiurgus. Let us suppose that there was a division of labour, and that one such personage had charge of the mineral and plant department of nature, with all the implicated physical laws, but had no cognizance of the region of sentient life and humanity; being at the same time forbidden to intrude his own emotions into his handiwork. Such a being would of course understand all the secrets of his own particular work; he would trace all physical consequences, and all organic consequences in the region of vegetation; he would know the yellow primrose; but not being thoroughly cognizant of the human mind, its susceptibilities and its actings, he could form no notion as to the way that the physical world would operate upon it. He would understand how gravity, cohesion, and other forces made mountains, but he would not understand how these produced emotions in human minds, quite apart from the physical structure. Knowing the deepest secrets of the physical world, in its own physical nature, he would yet be powerless to interpret it in any other way. Of its poetic capabilities and poetic meanings he would be wholly uninformed.

I observe that Principal Shairp, in his highly interesting and instructive volume—"The Aspects of Poetry"—uses, instead of interpretation, the "penetration" of nature. But whether it be stated in one form, or in the other, my contention is, that "assimilation" expresses the true state of the case; although the notion needs a farther specifying term, to bring out the poetic quality. This, however, is the case with interpretation and penetration. Newton was a grand interpreter, but not in the poetic acceptation. Bacon constantly describes man, in his capacity of scientific enquirer, as interpreting nature.

Another definition is the "spiritualising" of nature and life. This is much better, in so far that it indicates a difference between poetry and science, which the previous terms do not. It is defective chiefly in respect that it substitutes a term that itself wants defining. We can vaguely guess what is intended by it; we know the difference between matter and spirit, body and mind. If "personify" had been used, we should have understood it still better. We know that poetry is very largely occupied with personification; still this would not express all poetry. We understand "spiritual" in another sense, as opposed to "carnal," "fleshly," "grovelling." It is a word that belongs principally to religion, and only incidentally to poetry. There is a third mode of employing the term that is still less applicable, namely, to what is abstract, subtle, supersensual, immaterial, impalpable; this is the very negation of poetic form, which revels in the concrete and pictorial, giving to airy nothing a local habitation.

On Matthew Arnold's recent utterance respecting Poetry—"a criticism of Life"—I do not dwell at this stage. An able writer, both poet and critic, Mr. Alfred Austin, has taken it to pieces, in two recent numbers of the *Contemporary Review*, and has replaced it, as a definition, with a view of his own, which is unexceptionable so far as it goes, and serves one purpose of a good definition, namely, to bring reason to the aid of intuitive judgment in the subtler points of criticism. According to Mr. Austn, poetry is the imaginative raising or heightening of matter of fact. He illustrates this under the four heads—perception, feeling, thought, action: to which corresponds, he says, the four kinds of Poetry—Descriptive (perception), Lyrical (feeling), Reflective (thought), Epic or Dramatic (action).

Mr. Austin's criticism of Wordsworth from this standpoint is highly suggestive; and one would not find it easy to turn the flank of his reasoning, when he makes out certain passages to be wholly devoid of the poetic force or quality.

He pronounces this passage to be too literal for poetry. It is taken from "Simon Lee, the Old Huntsman":—

> And he is lean, and he is sick;
> His body, dwindled and awry,
> Rests upon ankles swollen and thick;
> His legs are thin and dry.
> One prop he has, and only one,
> His wife, an aged woman,
> Lives with him near the waterfall,
> Upon the village common.

Next is given an instance of imaginative transfiguration. It is called "The Reverie of Poor Susan." This is the first stanza:—

> At the corner of Wood Street, when daylight appears,
> Hangs a thrush that sings loud; it has sung for three years.
> Poor Susan has passed by the spot, and has heard,
> In the silence of morning, the song of the bird.

This is transfigurative, or imaginative, poetry.

How is it done, he asks, and says, "I really do not know." It seems to me, however, that some account of the transfiguring art is possible, although occasionally it is too complex for analysis. To go no farther: in thousands of instances, a simile does the work; and the precise reason for the effect can be given. Death is literal: "sleep" is perennially poetical, and any one of us can say why.*

What I strongly commend in Mr. Austin's definition is the employment of the words "emotion," "imagination," instead of the terms that have been already reviewed. To emotion we must come at last, in any precise definition. Yet, further, we must say what emotions are to be designated as poetical. According as we can specify and define these emotions, we shall succeed in laying a basis at least for the superstructure of a definition of poetic art.

The course that I am disposed to take in following out the present inquiry has been already shown in what I have printed on the subject; and I am not going here to repeat myself, except in a mere allusive summary.

It is necessary for me to recall only this much, namely, that I believe the definition of Poetry should be preceded by a consideration of Fine Art in general; that the province in Art is best approached by a review of the emotions appealed to, commonly designated as the feelings of the Beautiful, but admitting of being analysed into certain more elementary feelings of the mind which I have endeavoured to specify. These feelings are essentially pleasurable. Fine Art is, by the law of its being, productive of pleasure; only its pleasures are a select class, with peculiarities that entitle them to be regarded as elevating and refined, in comparison with our other pleasures, those of the inferior senses, for example. Art is contrasted with Utility, in the acceptation of supplying our ordinary wants, and saving us from injuries and pains; it assumes that we are physically provided for, and proposes to enhance our existence by superadded enjoyments not connected with mere physical well-being. Art is farther in contrast with Science, for reasons that will have to be noticed. There is a still other contrast, trenching on debated ground, with Morality or Duty.

If Fine Art as a whole is adequately defined, the species Poetry is definable by supplying the *differentia* —Language. The distinction between Poetry and the other members of the Art genus is notable and far-reaching, but the sole foundation is in the use of speech as the instrument. It is by employing the common medium of mutual understanding between man and man, the medium of our closest sympathies, and the medium of our highest knowledge of the world, that Poetry so easily oversteps its province, and slides into the functions of directing, persuading, and instructing mankind,—functions that the painter, sculptor, architect, or musician do not often arrogate to themselves.

So much for a review of the modes of approaching the definition of Poetry. I will endeavour to give sharpness to the outline now sketched, by fastening on a few of the moot points, or implicated problems, of poetical criticism.

1. I will take first the questions connected with the specifying character—Language. We may have Art, and Art emotions without language; but not poetical Art. We may gaze with rapture on a gorgeous sunrise, yet if we refrain from putting our feelings into words, we are not exemplifying poetry, nor, indeed, as yet, any Art. By an easily incurred fallacy, this situation is often considered a poetical one. It is so only by the licence of stating the part as the whole, the beginning as the consummation. Without the emotional susceptibility to start with, a man cannot be a poet; yet, until the feelings have been embodied in expression, they have not attained to poetry. The inarticulate susceptibility may go the length of assimilating the object in view with those other objects that harmonise with it, and that raise it from a literal object of the senses, to an object of æsthetic feeling. The personifying impetus, which, when applied to the face of inanimate nature, makes up such a large part of our poetry, may operate in the mind of a spectator, without any verbal expression whatever: it does actually operate in all of us, when we simply give way to our susceptibilities without evoking the response of our word-faculty. This is just half way to poetry; there is needed another advancing movement of mind, as co-essential to the final effect.

The direct function of language in this situation would be to put another in possession of the object that inspires ourselves; to give an adequate description of the literal effect, by the perfection of verbal resources for that end. The masses of colour in a grand sunrise might be brought within the conceptive power of others, who would be thus put into the position of the spectator (allowing for the inferiority of the most vivid description). Nay, more: language could give the assimilating object that wakens up the deeper emotion; indeed, language has a peculiar advantage here, which makes one of the high prerogatives of the poetic art. Homer in giving the descent of Apollo, in answer to the prayer of his priest, could put us in possession of the poetising comparison:—he came, like Night. A painter or sculptor has no such resource. This is the first great advance towards poetry in composition. In like manner, language has the means of making poetising *contiguities* as well as similarities, putting things together in such juxtaposition, that by acting together in the mind, they educe emotions not belonging to their preception separately. As in Milton's survey of the world from the mount of temptation:—

> Huge cities and high-towered, *that well might seem*
> *The seats of mightiest monarchs.*

The juxtaposition of the idea of monarchical residence heightens the effect of the literal prospect as defined by the epithets "huge" and "high-towered." The painter can also produce effects of juxtaposition, as when he gives effects of sky and light to chime in with a given scene. This does not detract from the poet's power; it only deprives him of the monopoly that he has in the previous case.

* We might here perform an operation, the opposite of parody, on Sancho Panza's fine humour, in his exclamation—"Blessings on the man that invented sleep." In seriousness, we may say, if the poetic metaphor of sleep for death had a single inventor, he deserved well of humanity.

Thus, by various and far-reaching similitudes, by well-chosen groupings or contiguities, language, in the hands of a master, converts mere susceptibilities of feeling and intellectual workings into something that transcends nature and becomes art. One other step remains to be taken; but that is a mighty one. I mean, of course, the power of language itself as an instrument of emotion and pleasure. I must abstain from analysing the music of speech in general, and the influence of metre or verse in particular. It is enough to remark that, taken alone, this element can be so handled as to impart pleasurable thrills of notable intensity, and such pleasure is reckoned as truly æsthetic in its kind. By its kindred to the other æsthetic feelings that we have adverted to, it strikes a chord in harmony with these, and so yields the highest form of æsthetic delight. On the other hand, should the expression not bring out a fine cadence in itself, and still more should it operate as a discord with the subject, it de-poetises the other elements; the last end is thus worse than the first. The language used can rarely be indifferent to a highly-pitched conception; hence the opinion that verse is essential to poetry; the march of verse being of itself the sign of a certain emotional intensity. Still, as metre or verse is only one form of language-impressiveness; as our English prose style has been cultivated into modes of expressing very varied emotions with perfect suitability, so much so that good prose is far better even than bad verse, it cannot be affirmed with any defensible propriety that nothing is poetry but what is clothed in the metrical garb.

Thus, then, we have made our way through the succession of steps whereby an æsthetic feeling in the presence of some great scene of nature has at last become poetry. The mere thrill of the susceptible mind in the view of a gorgeous sunrise is a first start, and only a start: mark now the consummation, and all the other steps that have led to it:—

> Full many a glorious morning have I seen
> Flatter the mountain-top with sovereign eye.

Again—

> Now morn, her rosy steps in th' eastern clime
> Advancing, sow'd the earth with orient pearl.

We might extend the illustration by citing the thunder-storm, as it simply affects the senses, and wakens up emotions thereby; and then by viewing it as embodied in Byron's description. It is æsthetic in the first stage; but only in the second, is it rendered into poetry.

Language, in these three examples, is in the full discharge of all its poetising functions; it assimilates and groups the things whose coalition is necessary to æsthetic thrill: it is farther adapted, according to its peculiar musical laws, to add its own modicum of æsthetic pleasure, and to crown the whole with the specifically artistic effect of harmony.

There are many occasions when the employment of verse, even although skilful to admiration, does not make poetry. I pass by the rules of Latin grammar, the mnemonic lines of the syllogism, and similar strokes of ingenuity, which choose the medium of verse from the incident of its being licensed to abbreviate for the sake of compactness. I would refer to some of Pope's striking couplets in his expository and didactic poems. I think that, in these, the metrical form is given to subjects in themselves unpoetical; and the intention is rather to impress the mind, as an expositor would, than to raise it into the regions of æsthetic pleasure. The figures of speech, and other arts for rousing attention, by the force of suspense, as epigram, interrogation, etc., are in that debateable margin between poetry and energetic exposition, where we ought not to make any dogmatic affirmation either way. It is easy to produce from Pope perfect, consummated, and typical poetry; place, by the side of these, specimens of his energetic, compact versification, where he condenses a proverb, a maxim, or a sarcasm, and the interval between the two is apparent to the most untutored sense.

Illustrations will be given under the head following.

(To be continued.)

—o—

Lessons in Latin.

BY THE REV. A. D. CAPEL, M.A., CANTAB.,

Formerly Examiner of Schools to Cambridge Local Examinations Syndicate.

KEY TO EXERCISES.

Exercise 33.

A.

1. Immediately the limbs of Æneas are loosened by cold. 2. They inhabit a hundred great cities. 3. It is night, and sleep had (Eng. possessed) the animals on the earths (Eng. earth). 4. Then a cold sweat dripped from his whole body. 5. And now a day, and the other (Eng. a second) day advanced (Eng. passed). 6. And then the priest sings these things from his divine mouth. 7. You see the image of Xanthus and Troy which your hands have made. 8. Afterwards he sees all things stand still in the serene heaven (Eng. sky). 9. The allies salute Italy with a joyful shout. 10. Suddenly the new form of an unknown man advances from the woods.

B.

1. Lupus et agnus juxta flumen stabant. 2. Lupus agno dixit, 'Cur meos haustus turbas?' 3. Agnus contra, 'Tuos haustus non turbo.' 4. Lupus dixit, ultimo anno mihi malefecisti. 5. Tum agnus lupum risit et dixit, 'Mea mater me tum non pepererat.' 6. Lupus deinde dixit, multis ante annis, tuus pater mihi malefecit. 7. Agnus nihil dixit. 8. Lupus agnum occidit et edit. 9. Malus homo mali rationem semper inveniet. 10. Malos homines ut venenum vitemus.

Exercise 34.

A.

1. You, O boys, are beloved by (your) parents. 2. O Cæsar, thou art loved by your fellow-citizens. 3. You (pl.) will be ruled by a queen after the king has died. 4. You, who are feared by all (men), art now taken. 5. You will send the boy to Rome, that he may be taught the Latin language. 6. Will you not be restrained by the prayers of your father? 7. The Trojans raise a shout to the stars from the walls. 8. Then next he raised aloft his burning shield with his left hand. 9. You, O boys, who do not say your lessons, will be beaten. 10. Then he seizes a great spear and throws it.

B.

1. Vos, O parentes, a vestris liberis decipimini. 2. Etiam nunc, O dux, non vincĕris. 3. Nonne tuum servum liberabis, ut laudĕris? 4. Romam redii ut puniaris. 5. Omnibus edendum est ut vivant. 6. Romam veni ne occiderer. 7. Meus pater et mea mater in Africa vivunt. 8. A vestris civibus timemini. 9. Nemini currendum est per urbem. 10. Facile est bene vivere quum homines nos amant.

EXERCISE 35.

A.

1. He raises himself on his sick thigh. 2. Hence the harbour of Drepanum receives me. 3. Now the elephants had borne themselves into the middle of the line of the foot-soldiers. 4. But fierce horror then for the first time stood around me; I was amazed. 5. I will place you safe on the threshold of your father. 6. You to whom the blood of life is whole, O you, hasten your flight. 7. O all-powerful Jupiter, if you are turned by any prayers, look upon us. 8. The father raises himself to the breezes and adores the sacred star. 9. I filled the roads with a shout, and sad called both again and again on Creusa. 10. But the great mother of the gods detains me on these shores.

B.

1. Puella acu se læsit. 2. Magister vos, O pueri verberavit, quia dictata non didiceratis. 3. Dixit mihi abire. 4. Quis non veniet ut Ciceronem audiat? 5. Sæpe Cæsarem dicere audivi, pugnandum est, milites. 6. Me gladio multum læsi. 7. Cuncti se amant. 8. Nonne cunctis discendum est ut se conservent. 9. A vobis lædebamur. 10. Hieme Romam vĕnit.

LESSON XXXVI.

INFINITIVE WITH ITS SUBJECT.

261. The infinitive mood has already been described as the nom. or acc. of the verbal substantive when the simple meaning of the verb is expressed.

262. The infinitive mood, as a nom. case, has already been discussed in Lesson XXI.

263. We have frequently inserted an English infinitive in brackets as the English idiom for 'that he may, or might,' etc., but not expected the student to judge for himself whether the subjunctive with a conjunction or the Latin infinitive ought to be used.

264. When a Latin infinitive has a subject in the acc. case, it is always introduced in English by the word 'that.'

265. To discover whether the verb in a subordinate clause is to be translated by a subjunctive, with a conjunction, or by an infinitive mood with or without a subject; all that has to be done is to hyphen the words of the clause together, and see whether it answers the question what? or why? to the principal sentence. If the subordinate clause answer the question, what? the clause is a substantive one, and the verb must be in the infinitive mood, with its subject in the acc. case; but if the clause answer the question, why? the verb must be in the subjunctive mood, properly connected by means of a conjunction.

266. In the sentence, 'He came to conquer,' 'To conquer' answers the question, why he came? and therefore must be put into the subjunctive mood with 'ut.'

267. In the sentence, 'Cæsar said that he would conquer,' 'He would conquer' is what Cæsar said, therefore it must be put into the infinitive mood, and its subject, 'he,' expressed.

268. The infinitive having the same form for all persons and numbers (hence the name infinite), the subject must always be expressed.

269. If the subject of the infinitive be the same as that of the principal verb, and of the third person, we must use the reflexive pronoun, 'se, sui,' etc.

270. The verbs 'ask, command, advise, and strive,' seem to be exceptions to the above rule, as clauses which seem to answer 'what?' after these verbs are always expressed by the subjunctive with a conjunction. Yet in the sentence, 'I advise you to learn,' which in Latin would be expressed by, 'I advise you that you may learn,' the infinitive mood 'to learn really answers the question 'Why do I advise you?' as much, or more than, the question, 'What do I advise you?'

271. The student, however, is advised to remember that these four verbs, 'ask, command, advise, and strive,' are exceptionally followed on all occasions by the subjunctive with a conjunction.

272. The perfect infinitive is formed by adding 'isse' (slightly changed from 'esse,' Eng. 'to be') to the perfect root.

273. In the infinitive mood there are 6 tenses, though only 3 forms; *e.g.*, 'amare' is not only the Pres. Inf. of the verb, but also the imperfect of the same mood. So also 'amavisse' is both perf. and plup., and the future form, which we shall know when we have discussed the third root of verbs, is not only the Fut. Pres., but also the Fut. Perf., though rarely used in this sense.

274. The parsing of an infinitive mood and its subject are as follows:—taking as example, 'Certum est Cæsarem hostes vicisse.' Eng., 'It is certain that Cæsar conquered his enemies.'

Cæsarem Vicisse	N V	I act	is inf.	m perf.	s	ac	Sub. vicisse dept. on 'est.'

275. VOCABULARY 36.

	m. f. n.		
Certain	Certus -ta- tum.	R. Cert	Certificate
To burn	Incendere.	P. R. Incend	Incense
It is an allowed fact	Constat. (impersonal)		
Offspring	Partus	G. partus	Parturition
To breathe	Respīrare	R. Respir	Respiration
To command	Impĕrare	R. Imper	Imperative
To lay down	Dēpōnere	P. R. Depŏsu	Deposition
Arms	Arma (no Sing.	O. decl. n.g.)	Armour
Amongst	Inter, prep. gov. acc. case.		
To wander	Errare	R. Err	Erratic

276. EXERCISE 36.

A.

1. Certum est Ciceronem bene (21) dixisse (15). 2. Dixit (15) se (35) urbem (7) incendisse. 3. Audio (4) te (35) heri (27) dictata (12) recitavisse (14). 4. Meus (20) pater (14) mihi (35) dixit (15) se (35) meam (20) matrem 14) læsisse (4). 5. Veni (19) ut Romam videam (27). 6. Dixit (15) Hamilcarem

Africam reliquisse (26). 7. Rogavit (19) ut Romam veniret (19). 8. Moneo (30) te (35) ut epistolam (7) scribas (4). 9. Constat omnia (29) animalia (27) partus amare (2). 10. Nonne certum est hominibus (5) arandum (2) esse (infinitive of 'est') antequam (14) messem (7) metunt (12).

B.

1. It is an allowed fact that men (5) are (Lat. 'esse') animals (27). 2. Cæsar told (15) the people (16) he (35) had conquered (23) the Gauls (10). 3. Is it not certain that we must all (29) labour (13) that we may live (6)? 4. In the winter (16) men (5) left (26) the city (7) of Rome. 5. I advise (30) you (35) to wash (23) yourself (35). 6. We commanded the soldiers (6) to lay down their (20) arms. 7. All (men) (27) know (14) that Pyrrhus was (Lat. fuisse) the king (8) of Epirus. 8. It is an allowed fact that Hannibal was (Lat. fuisse) a great (20) general (2). 9. I have learnt (27) many (things) (20) but (6) say (15) little (Lat. 'pauca,' lit. few things). 10. Amongst whom (27) (Eng. 'and amongst them') Dido was wandering in the great (20) wood (11).

LESSON XXXVII.

Demonstrative Pronouns.

277. The demonstrative pronouns are 'hic' (Eng., 'this one here'), 'ille' (Eng., 'that one there'), 'is' (Eng., 'this,' or 'that,' usually followed by 'qui,' or referring to some person or thing in the sentence other than the subject), 'idem' (Eng., the same), and one or two others which we will discuss in a future lesson.

278. These pronouns retain the old genitive in 'ius' or 'jus,' and dative in 'i.' Otherwise, excepting 'hic,' which must be particularly noticed for its irregularities, they are declined like 'o' and 'a' adjectives.

279. Here are the full declensions:—

Singular.

	m.	*f.*	*n.*	*m.*	*f.*	*n.*
N.	Hic	Hæc	Hoc	Ille	Illa	Illud
Ac.	Hunc	Hanc	Hoc	Illum	Illam	Illud
G.	Hujus, all genders			Illius, all genders		
D.	Huic	,,		Illi	,,	
Ab.	Hoc	Hac	Hoc	Illo	Illa	Illo

Plural.

N.	Hi	Hæ	Hæc	Illi	Illæ	Illa
Ac.	Hos	Has	Hæc	Illos	Illas	Illa
G.	Horum	Harum	Horum	Illorum	Illarum	Illorum
D.,Ab.	His, all genders			Illis, all genders		

	Singular.					
N.	Is	ea	id	Idem	eadem	idem
Ac.	Eum	eam	id	Eundem	eandem	idem
G.	Ejus, all genders			Ejusdem, in all genders		
D.	Ei	,,		Eidem	,,	
A.	Eo	ea	eo	Eodem	eadem	eodem

	Plural.					
N.	Ii	eæ	ea	Iidem	eædem	eadem
A.	Eos	eas	ea	Eosdem	easdem	eadem
G.	Eorum	earum	eorum	Eorundem	earundem	eorundem
D.	Iis or eis, in all genders			Iisdem or eisdem, in all genders		

280. The forms of 'idem' are obtained from those of 'is' by adding 'dem,' and changing final 'm's into 'n' before adding the 'dem;' thus 'eumdem' is written 'eundem.'

281. The English of 'idem' is, as above, 'the same'; but often it can only be translated by 'he,' etc., like 'is,' when referring to another than the subject who has been mentioned in the sentence.

282. There is no definite article in Latin at all corresponding to the one in Greek, but Latin translators of the Greek Test. often use 'ille' for that purpose. Old Latin Grammars used to put 'hic' before all the words declined in the Etymology; so poor little lads had, perhaps, the very first day of their experience in Latin, to learn the most irregular word in the language—aggravated in a few days by the introduction of a noun of common gender, necessitating both the masculine and feminine forms of 'hic,' to be put before each case of the noun. Who can count up the number of young hearts that have well-nigh broken under that crucial test of 'Hic et Hæc parens,' etc.!

283. Vocabulary 37.

English.	*Latin.*		*Derivatives.*
To perceive	Cernĕre	P. R. Crēv	
To sit down	Consīdere	P. R. Consēd	
Rock	Rūpes	G. Rupis	
Cēlæne	Celæno	G. Celænus (proper name)	
Unhappy	Infēlix	G. Infēlic.	
Prophet(m.orf.)	Vātes	G. Vatis. c.g.	Vaticination
To break forth	Rumpere	P. R. Rūp	Rupture
Breast	Pectus	G. Pectoris	Expectorate
To break (law or word)	Viŏlare	R. Viol	Inviolable

	m.	*f.*	*n.*		
Unburied	Inhŭmātus	-ta	-tum	R. Inhumat	Exhume
Sleep-bringing	Sŏpōrus	-ra	-rum	R. Sŏpor	Soporific
Promised	Prōmissus	-sa	-sum	R. Promiss	
Very lofty	Præcelsus	-sa	-sum		
Latin	Latīnus	-na	-num	R. Latin	
To burn (neut.)	Ardēre			P. R. Ars	Arson
Author	Auctor			G. Auctoris	
To reject	Spernĕre			P. R. Sprēv	
In turn	Vicissim (adv.)				
Helpless	Inops			R. Inŏp	
Crowd	Turba			G. Turbæ	Disturb
Ghost / Shadow	Umbra			G. Umbræ	
Cause	Causa			G. Causæ	Causal
Sleep	Somnum			G. Somni, n.g.	Somniferous
Pardon	Vēnĭa			G. Veniæ	Venial
Before, in the presence of	Cōram, prep. gov. ab. case				
To arouse	Excĭtāre			R. Excit.	Excitement
To take away	Eximĕre			P. R. Exēm	Exemption
From	Ex, prep. gov. ab. case				
Milestone	Milliārium			G. Milliarii, n.g.	
Not only— but also	Non sŏlum—Sed ĕtiam, conj.				
Victory	Victōria			G. Victoriæ	Victory
To have begun	Cœpisse (no pres. tenses)			P. R. Cœp.	
To claim	Exĭgere			P. R. Exĕg	Exact
To create	Creāre			R. Cre.	
Help	Auxĭlium			G. Auxilii, n.g.	Auxiliary
To cut to pieces	Cædĕre			Cĕcīdi	
Camp	Castra, O. decl. n.g. (no sing.)				

284. Exercise 37.

A.

(H. stands for the poet Horace.)

1. Hæc omnis (29) quam (27) cernis inops inhumataque turba est (V.). 2. Umbrarum hic locus (9) est, Somni Noctisque (29) soporæ (V.). 3. Scimus (14) et hanc veniam petimusque (9) damusque (12) vicissim (H.). 4. Hoc amet (2) hoc spernat promissi carminis (9) auctor. 5. Una (Eng., alone) in præcelsa consedit rupe Celæno, Infelix vates, rumpitque hanc pectore vocem (7). 6. Scan these two lines of Virgil in sentence 5, beginning the second line with 'Infelix.' Note the *elision* in the second line. 7. Occidit (30) eos homines (5) qui (27) ex urbe (7) evolaverant (2). 8. Easdem leges (5) violat quæ (27)

coram populo (16) laudat (2). 9. Hic homo (5) bonus (20) est, ille malus (33). 10. Et Tullus et Ancus regnaverunt (4), ille cum domo (1) sua (20) arsit, hic morbo (26) periit (26).

B.

1. That man (5) who (27) broke his word (23) will lose (20) his life (11). 2. I have before (19) heard (4) the same (things) which (27) you are now (27) telling (15) me (35). 3. Of (Lat. 'ex' with abl). Horace (6) and Virgil (Lat. Virgilius) I praise (2) the former (Lat. ille), but (6) love (2) the latter (Lat. hic). 4. On account of (29) which (27) cause Brutus aroused the people (16) and took away the power (28) from Tarquin (dat. case) (17). 5. These men (18) sat down at the second (20) milestone from (Lat. 'ab') the city (7) across (12) the river (5). 6. The crow (18) not only gave (12) him (proper case of 'is' not being the subject of the sentence) victory, but also a name (20). 7. The Latins began to claim this also (20) from the Romans, that (ut) one (31) consul (17) should be created from (26) their (proper case of 'is') (people), the other (31) from the people (16) of the Romans (20). 8. These asked (19) Pyrrhus for help (acc. case) against (17) the Romans (20). 9. He (prop. case of 'is') who (27) first fought (10) with (20) an enemy (10) from-across-the sea (20) came (19) to Italy (20). 10. Curius fought (10) against (19) him, cut to pieces his army (19) and took (26) the camp.

(To be continued.)

Christmas Certificate Examination, 1882.

(Continued from page 392.)

MALE AND FEMALE CANDIDATES (FIRST YEAR).

British History.

Three hours allowed for this paper.

Candidates are not to answer more than EIGHT questions.

14. Describe fully one of Marlborough's campaigns.

Marlborough returned to the Continent in 1704. He then found that the Elector of Bavaria had been gaining great successes against the Emperor. He therefore marched through Maestricht into Germany, passed the Wernitz, and attacked a division of the Bavarian army at Schellenberg, near Donnawert. He gained a victory, and forcing the Bavarian lines, drove his enemy before him across the Danube, compelling him to take shelter under the guns of Augsburg. The Elector now wished to make terms, and was almost ready to make unconditional surrender. He however tried to form a junction with Tallard, and succeeded, as did Marlborough in joining Prince Eugene. In August, Marlborough came upon the enemy at Blenheim, near the Danube. Breaking the centre of the lines of the enemy, utter confusion resulted, and a great victory was the result. The successes, however, were not followed up, and the enemy recovered lost ground in the following year. Marlborough went to Berlin, and returned to London the same year.

15. The reign of George III. has been described as 'the most eventful period in the annals of mankind.' Can you justify this description?

A short statement of the events which happened in the reign of George III. will justify the assertion contained in the question. It commenced by witnessing the close of the Seven Years' War, and the retention by England of Canada, one of the foremost of her colonial possessions, settling for ever the question of the supremacy of the Saxon over the Latin race. Then came the American War of Independence, which lost this country the whole of the United States, but resulted in the formation of a republic, which bids fair to be the most powerful nation in the world. On the Continent of Europe were witnessed the execution of a king, the establishment and overthrow of a republic, the beginning and the end of an empire, the rise and fall of Napoleon, and the immense success of the English arms by land and by sea, under Wellington and Nelson. At home there was the rebellion in Ireland, resulting in the political union of the two countries; while the Peterloo massacre paved the way for the reform of our political institutions. Captain Cook made three voyages round the world, the steam-engine was improved, the spinning-jenny, the mule, and the power-loom were invented, and the first steam-vessel was launched. Such a combination of events amply justifies the statement, that the reign of George III. was 'the most eventful period in the annals of mankind.'

16. Mention the names of the leading statesmen of the reigns of George II. and William IV. Describe the career of the one who has excited your sympathy.

The chief statesmen of the reign of George II. were Sir Robert Walpole, the Duke of Newcastle, William Pitt, and Henry Fox, afterwards Lord Holland. Those of William IV. were the Duke of Wellington, Earl Grey, Lord John Russell, Lord Palmerston, and Sir Robert Peel.

William Pitt, the 'Great Commoner,' was born in 1708. Early in his political career he distinguished himself by attacks on Sir Robert Walpole, whom he assisted in driving from power. He held subordinate offices in Henry Felham's administration, and assisted the Duke of Devonshire in forming a ministry in 1756. Dismissed from office in the following year, the indignation of the people was roused, and he was recalled to power. During this time Canada was conquered, and the British arms were everywhere successful. He was created Earl of Chatham in 1766, and opposed strongly the steps taken to coerce the colonists in America by Lord North's ministry. While making a speech on the American war, now frequently used as a specimen of oratory, he fell in a fit and died a few weeks afterwards, A.D. 1778.

17. Mention the causes which led to the Indian Mutiny, and the chief incidents of that outbreak.

The chief cause of the Indian Mutiny was the introduction of the Enfield rifle, which necessitated the use of greased cartridges. The report being spread that the grease was the fat of swine or cows, to touch which was considered a defilement to a Hindoo, the native princes, smarting under the loss of their possessions through misgovernment, used this as an incentive to rebellion.

The mutiny broke out in May, Delhi being captured by the natives. It was, however, retaken by General Wilson in September of the same year. Cawnpore fell into the Sepoys' hands, and a dreadful massacre of men, women, and children, took place under Nana Sahib. Lucknow was besieged, and the residents underwent terrible sufferings, but were eventually relieved, temporarily by Havelock and Outram, and permanently by Sir Colin Campbell, afterwards Lord Clyde. Clyde succeeded, with a small force, in subduing one place after another in the whole of the disturbed district, till the final overthrow of the rebellion in 1858.

BALLOONING.—Aeronauts have been distinguishing themselves lately by the frequency of their voyages. On July 14, we find a balloon descending in Kent with two travellers from Belgium, who had been carried across the Channel without any intention of so doing. Six days later three French aeronauts endeavoured to cross from Marseilles to Algeria; their balloon descended, however, near Corsica, and the travellers only escaped by throwing everything overboard, when the balloon rose slightly and was safely carried as far as Italy. On 1st August, Sir Claude de Crespigny and Mr. Simmons safely crossed from Maldon to Flushing after a seven hours' journey. On August 4th two Frenchmen were again unwillingly wafted across to 'perfidious Albion,' and on the 7th, M. l'Hoste, notwithstanding his narrow escape in the North Sea a few weeks before, made his fourth attempt to cross the Channel from Boulogne, but had to descend a few hours later in Flanders.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR' FOR NOVEMBER, 1883.

STANDARD IV.

A. 1. 2,678,400 sec.
2. £6255 7s. 11¼d.
3. £69 2s. 1⅝d.,—61.
B. 1. 758 ton 3 qr. 22 lb. 15 oz.
2. 1,881,792 sq. in.
3. £102,425 1s. 1½d.
C. 1. £562 11s. 3⅜d.
2. £17 16s. 8½d.
3. 704 gills.
D. 1. 153,792 c. in.
2. 125 w. 6 d. 17 h. 45 min. 49 sec.
3. £21 19s. 2d.

E. 1. £8 9s. 2¾d., — 50,643.
2. £53 6s. 8d.
3. 57 shirts (4 yd. 3 nl. left).
F. 1. £6,124 7s. 9d.
2. £285.
3. 8d. a gross.

Advanced Examination.

1. 6.19 p m.
2. £51 1s. 3d.
3. 5 w. 5 d. 20 h. 28 m. 45 s.,—75,096.

STANDARD V.

A. 1. £250 7s. 2½d.
2. 2⅜.
3. £26 18s. 1½d.
B. 1. £10 4s. 9d.
2. 1 1/10.
3. £799.
C. 1. £6,940 10s. 5½d.
2. 528 slates.
3. £16 6s. 4⅜d.
D. 1. £48 3s. 11 1/10d.
2. 20 1/10.
3. £136,549 14s. 7d.

E. 1. 2 cwt. 1 qr. 20 lb.
2. £79 5s.
3. £72 4s. 8 2/11d.
F. 1. 1 9/10.
2. £13,888 17s. 9½d.
3. £415 19s. 7½d.

Advanced Examination.

1. £375 gain.
2. 3½ days off work.
3. £1 0s. 4¾d.

STANDARD VI.

A. 1. 3.
2. ·02421875.
3. 11s. 4 3/11d.
B. 1. £19 6s.
2. 268·2.
3. £180.
C. 1. £107 4s. 4d.
2. £425 5s.
3. 1,260.
D. 1. 12.
2. £121 18s. 1½d.
3. 1 7/15 oz.

E. 1. 14s. 3 1/10d.
2. 3 3/11 ton.
3. 9/17 pint.
F. 1. £6 0s. 11 1/10d.
2. 9s. 2 5/11d.
3. £4 2s. 2 2/11d.

Advanced Examination.

1. £550.
2. 32 1/11 min. past 12 p.m.
3. £19 9s. 4·18285714d.

STANDARD VII.

A. 1. £1 19s. 8d.
2. £1 18s. 9 9/11d.
3. 6 2/3 per cent.
B. 1. 1 1/4 2/11d.
2. £48 15s. 10·0940625d.
3. £23 3s. 11 1/11d.
C. 1. £1 6s. 1 1/11d.
2. 6⅔d.
3. 120 years.
D. 1. £8,002 16s.
2. £717 14s. 0 1/11d.
3. 3 1/11 per. cent.

E. 1. 5·8463 feet.
2. 96 per cent. gain.
3. £89 5s. 8⅓d.
F. 1. 27½ per cent.
2. £36 18s. 5 7/11d.
3. £44 16s. 7·65515625d.

Advanced Examination.

1. 3 2/11 per cent.
2. 663 to 250.
3. 9 1/11 months.

SOLUTIONS OF THE 'ADVANCED EXAMINATION' QUESTIONS IN 'THE SCHOLAR' FOR NOVEMBER, 1883.

STANDARD IV.

1. From Nov. 8th at 6.30 a.m. to Nov. 24th at 6.30 p.m. is 16 days; and 40 sec. × 16½ = 660 sec. = 11 min., and 11 min. from 6.30 p.m. = 6.19 p.m. Ans.

2. 5 ton 15 cwt. = 12,880 lb., less 8 lb. × 5¾ or 46 lb. = 12,834 lb. sold, which at 7½d. a lb. = 96,255d. = £401 1s. 3d. selling price. Then £401 1s. 3d. − £350 = £51 1s. 3d.

3. This question being given merely as a test of *mechanical* accuracy, no solution is necessary.

5w. 5d. 20h. 28m. 45s., − 75,096. Ans.

STANDARD V.

1. The *cost* of the horses is superfluous data, being merely given as 'dust' or 'chaff' to test the worker's perceptive faculties. £10 × 25 = £250, + £5 × 30 = £150, − £5 × 5 (rem.) = £375 gain. Ans.

2. As the man receives 5s. 6d. a day when working, and is fined 1s. 3d. a day when off work, the *difference* a day between working and not working is 6s. 9d. And 5s. 6d. × 25 = £6 17s. 6d. wages if working full time; hence £6 17s. 6d. − £5 13s. 10½d. = £1 3s. 7½d. loss, which ÷ 6s. 9d. = 3½ days off work. Ans.

3. 3 ton 18 cwt. 70 lb. = 8806 lb. and £201 16s. 1d. ÷ 8806 = 5½d. a lb.; and 5½d. × 44½ = £1 0s. 4¼d. Ans.

STANDARD VI.

1. The interest on £100 at 4 per ct. for 9 months is £3, hence £103 will be repaid for every £100 borrowed; then 100/103 of £566 10s. = £550. Ans.

2. As A can do the whole in 12 hours, and as he is left alone with 2 hours' work, this work is ⅙ of the whole; hence A and B *together* will do ⅔ of the work, that is before B leaves. Again, 1/12 + 1/16 = 7/48, part done by them in one hour, and ⅔ = 32/48, hence 50 ÷ 11 = 4 4/11 hr., time they are working together, + 2 hours A alone = 6 8/11 hours past 6 a.m. = 12 8/11 = 12 − 32/11 p.m. Ans.

3. ·425 = 17/40 = 68/160, and 7/32 = 35/160, hence the ratio of wine to brandy in value is 35 to 68. Again, as 3·15 pints cost 8·35s., 315 pints cost 835s.; and 9·45 gallons = 75·6 pints. Then by proportion and cancelling,

$$\frac{835\text{s.} \times 75{\cdot}6 \times 68}{315 \times 35} = 389{\cdot}34857142\text{s.} =$$

£19 9s. 4·18285714d. Ans.

STANDARD VII.

1. From

Jan. 1st to Apl. 15th inclu.	is	105	dys. at	3	p.c. =	315	dys. at 1 p.c.
Apl. 16 „ Sep. 27	„	165	„	4	„ =	660	„ „
Sep. 28 „ Nov. 25	„	59	„	3½	„ =	206½	„ „
Nov. 26 „ Dec. 31	„	36	„	4½	„ =	162	„ „
		Making a total of				1343½	„ „

Hence 1343½ ÷ 365 = 3 268/730 p. ct. average. Ans.

2. A boy's earnings are 1 8/11 = 9/5 of a girl's; a woman's are 1 3/11 = 14/11 of a boy's; and a man's 1 7/10 = 17/10 of a woman's. Then if a girl's earnings are represented by 1, a man's will be 17/10 of 14/11 of 9/5 of 1 = 1 1071/1100 = 2142/1100; hence the ratio is 663 to 250. Ans.

3. £85 − £82 10s. = £2 10s. = 50s. discount,—that is *interest* on £82 10s. at 4 per cent. for the unknown months. £82 10s. at 4 p. ct. for a *year* = £3 6s. = 66s.

Hence 50/66 of 12 months = 9 1/11 months. Ans.

ANSWERS TO ARITHMETICAL QUESTIONS IN THE 'LITTLE LEARNER' FOR NOVEMBER, 1883.

STANDARD I.

A. (1) 90
(2) 265
(3) 207
B. (1) 3,214
(2) 1,096
(3) 1,295
C. (1) 1,484
(2) 1,532
(3) 2,658
D. (1) 25
(2) 625
(3) 312
E. (1) 205
(2) 114
(3) 185

F. (1) 188
(2) 85
(3) 47
G. (1) 27,194
(2) 10,926
(3) 7,518
H. (1) 2,764
(2) 3,092
(3) 464
I. (1) 6,121,816
(2) 63 scholars
(3) 711 pounds
J. (1) 5,448,423,630
(2) 473 apples
(3) 183

STANDARD II.

A. (1) 92,190
(2) 311,919
(3) 112,596

B. (1) 26,137
(2) 69,105
(3) 3,588

C. (1) 531,083
(2) 4,437,630
(3) 34,518,000

D. (1) 2,524,962
(2) 8,085,694
(3) 33,428,538

E. (1) 182,514,360
(2) 401,436,888
(3) 6,958,251,630

F. (1) 7,438
(2) 16,861 + 4
(3) 6,789

G. (1) 3,839 + 3
(2) 7,984 + 7
(3) 7,835

H. (1) 996 + 87
(2) 1,545 + 384
(3) 2,496

I. (1) 82 pence ; 4,080 pence
(2) 352 horses
(3) 869

J. (1) 70 tops
(2) 294 pence
(3) 504,360 pages

STANDARD III.

A. (1) 2,357
(2) 826 + 7
(3) 1,279

B. (1) 2,743 + 34
(2) 11,635 + 19
(3) 4,090

C. (1) 34,954 + 127
(2) 3,708
(3) 8,212 + 295

D. (1) 18,488 + 3,435
(2) 4,520 + 6,406
(3) 8,605

E. (1) £27 3s. 3d.
(2) £98 2s. 4½d.
(3) £3,148 19s. 8½d.

F. (1) £7,184 19s. 7¾d.
(2) £12,445 18s. 9d.
(3) £104,101 13s. 10¾d.

G. (1) £83 6s. 9d.
(2) £107 18s. 5½d.
(3) £799 7s. 4¾d.

H. (1) £85 18s. 0¾d.
(2) £6,186 9s. 4½d.
(3) £67,284 17s. 11½d.

I. (1) £1 5s. 7½d.
(2) 320 boys
(3) £6 3s. 8½d.

J. (1) 49,630
(2) 16,986 farthings
(3) £11 16s. 9d.

ANSWERS TO
Pupil Teachers' Examination Papers.

SEPTEMBER 29.

FIRST YEAR.

Pupil Teachers at end of First Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. What fraction of $5\frac{1}{3}$ of $1\frac{1}{5}$ of 7s. 1d. is $\frac{5\frac{1}{3}-3\frac{1}{3}}{3\frac{1}{3}}$ of 15s. $11\frac{1}{4}$d.?

(*a*) $5\frac{1}{3}$ of $1\frac{1}{5}$ of 7s. 1d. $=\frac{16}{3}$ of $\frac{6}{5}$ of 340 far.

(*b*) $\frac{5\frac{1}{3}-3\frac{1}{3}}{3\frac{1}{3}}$ of 15s. $11\frac{1}{4}$d. $=\frac{1\frac{1}{3}}{3\frac{1}{3}}$ of 191¼d.

$=(\frac{4}{3}\div\frac{3}{10})$ of 765 far.

$=\frac{4}{3}\times\frac{10}{3}$ of $\frac{1}{17}$ of 765 far.

∴ the fraction required $=(\frac{4}{3}$ of $\frac{10}{3}$ of $\frac{1}{17}$ of $765)\div(\frac{16}{3}$ of $\frac{6}{5}$ of 340)

$$=\frac{765\times23\times8\times4\times9}{12\times27\times23\times16\times340}=\frac{1}{\underline{\underline{10}}}\text{ Ans.}$$

2. State the rule for converting a circulating decimal into a vulgar fraction. Express 4·2$\dot{3}$, ·176$\dot{3}$, ·06$\dot{3}\dot{9}$, and ·2428571 as vulgar fractions in their lowest terms.

RULE.—If the circulating decimal be *pure*, as ·06$\dot{3}\dot{9}$, place underneath it as many nines as there are figures in the circle. But if it be *mixed*, as ·176$\dot{3}$, subtract the figures that do not recur from the whole expression as far as the end of the first circle; take this difference as the numerator, and for the denominator place as many nines as there are figures in the repeating part, followed by as many ciphers as there are figures in the non-recurring or finite part.

$$4\cdot2\dot{3}\quad=4\frac{23-2}{90}\quad=4\frac{21}{90}\quad=\frac{\underline{127}}{30}\text{ Ans.}$$

$$\cdot176\dot{3}\quad=\frac{1763-17}{9900}\quad=\frac{1746}{9900}\quad=\frac{\underline{97}}{550}\text{ Ans.}$$

$$\cdot06\dot{3}\dot{9}\quad=\frac{639-0}{9990}\quad=\frac{639}{9990}\quad=\frac{\underline{71}}{1110}\text{ Ans.}$$

$$\cdot2428571\quad=\frac{2428571-2}{9999990}=\frac{2428569}{9999990}=\frac{\underline{17}}{70}\text{ Ans.}$$

3. Find the rent of 40 acres 3 roods 20 poles, at £3·365 per acre.

£3·365 = price of 1 ac.

×40

	134·600	=	,,	40 ac.
2 ro. = ½ of 1 ac.	1·6825	=	,,	2 ro.
1 ,, = ½ of 2 ro.	·84125	=	,,	1 ro.
20 ,, = ½ of 1 ro.	·420625	=	,,	20 po.
	£137·544375	=	,,	40 ac. 3 ro. 20 po.

×20

10·8875s.

×12

10·65

∴ £137 10s. 10½d. = Ans.

4. A man bequeaths ⅔ of his property to his eldest son, ⅓ of the remainder to each of his four younger sons, ⅔ of the remainder still left to his daughter, and the residue, which amounted to £1400, to charities. What was the amount of his property?

(*a*) Eldest receives ⅔, ∴ the rem. is ⅓.

(*b*) ⅓ of ⅓ to each of 4 takes $\frac{4}{9}$, and the rem. is $\frac{1}{3}-\frac{4}{9}$ or $\frac{1}{9}$.

(*c*) ⅔ of $\frac{1}{9}$ to the daughter takes $\frac{2}{27}$ of the whole.

(*d*) ∴ the residue is $1-(\frac{2}{3}+\frac{4}{9}+\frac{2}{27})=\frac{180-(40+112+21)}{180}=\frac{7}{\underline{\underline{180}}}$

Hence 7 : 180 :: £1400 : amount of his property.

$$\frac{£1400\times180}{7}=\underline{\underline{£36,000}}\text{ Ans.}$$

FEMALES.

1. The children of a school can be arranged in rows of 14, 21, 28, or 42. How many are there?

The L. C. M. of 14, 21, 28, and 42 will give the No. of children.

7	14,	21,	28,	42
2	2,	3,	4,	6
3	1,		2,	2
		1		

∴ L. C. M. $=3\times2\times2\times7=\underline{\underline{84}}$ Ans.

2. Find, by practice, the cost of digging 250 acres 3 roods 14 poles at 2½ guineas per acre.

£ s. d.
2 12 6 = price of 1 ac.

×250

	656	5	0 =	,, 250 ac.
2 ro. = ½ of 1 ac.	1	6	3 =	,, 2 ro.
1 ro. = ½ of 2 ro.		13	1½ =	,, 1 ro.
10 po. = ⅖ of 1 ,,		3	3½ =	,, 10 po.
4 ,, = ⅒ of 1 ,,		1	3½ =	,, 4 po.
	£658	8	11½ =	,, 250 ac. 3 ro. 14 po. Ans.

3. Prove that $5\frac{1}{3}+3\frac{1}{3}=4(5\frac{1}{3}-3\frac{1}{3})$.

(*a*) $5\frac{1}{3}+3\frac{1}{3}=\frac{16}{3}+\frac{10}{3}=\frac{80+48}{15}=\frac{128}{15}$ (1st result)

(*b*) $4(5\frac{1}{3}-3\frac{1}{3})=4\left(\frac{80-48}{15}\right)=\frac{32}{15}\times4=\frac{128}{15}$ (2nd result)

∴ $5\frac{1}{3}+3\frac{1}{3}=4(5\frac{1}{3}-3\frac{1}{3})$; because each $=\frac{128}{15}$ or $\underline{\underline{8\frac{8}{15}}}$.

4. Make out the following bill :—3½ cwt. of coals at 10½d. per cwt., 13 lb. of cheese at 7½d. per lb., 2¾ lb. of tea at 3s. 3d. per lb., 17 lb. sugar at 3½d. per lb., 8½ yds. flannel at 1s. 11½d. per yard.

		s.	d.		£	s.	d.
3½ cwt.	at	0	10½	per cwt. =	0	3	0½
13 lb.	,,	0	7½	,, lb. =	0	8	4½
2¾ lb.	,,	3	3	,, ,, =	0	8	11¼
17 lb.	,,	0	3½	,, ,, =	0	4	11½
8½ yds.	,,	1	11½	,, yd. =	0	16	7½
					2	2	0 Ans.

Grammar.

MALES AND FEMALES.

1. 'I live in *oaken* bower,
To *nurse* the saplings *tall* and *curl* the grove
With ringlets quaint,
And *all* my plants I *save* from nightly *ill*
Of noisome winds.'

MILTON.

Analyse the above sentences, parsing the words in italics.

ANALYSIS.

Sentences.	Kind.	Subject.	Predicate.	Object.	Extensions.	Connective.
1. I live in oaken bower, to nurse the saplings tall and curl the grove with ringlets quaint.	Principal	I	live		in oaken bower (*place*) to nurse the saplings, (to) curl the grove with ringlets (*purpose*)	
2. And all my plants I save from nightly ill of noisome winds.	Principal	I	save	all my plants	from nightly ill of noisome winds (*complementary*)	and

PARSING.

Oaken—dist. adj., qual. 'bower.'
nurse—reg. trans. verb, infin., pres., indef., gov. by 'live.'
tall—predic. adj., qual. 'saplings.'
curl—reg. trans. verb, infin., pres., indef., gov. by 'live.'
all—indef. numeral adj., qual. 'plants.'
save—reg. trans. verb, indic., pres., indef., 1st pers., sing., agr. with subj. 'I.'
ill—abstr. noun, neut., sing., obj., gov. by 'from.'

2. Explain the force of the termination in the following words:—Oaken, sapling, ringlets, noisome, nightly, and give instances of words with similar endings.

TERMINATION.	MEANING.	EXAMPLES.
en	made, or consisting of	ashen, golden, wooden
ling	little (a diminutive)	duckling, gosling, darlings
let	little ,,	streamlet, rivulet, cutlet
some	full of, consisting of	lonesome, handsome, fulsome
ly	like	manly, homely, kingly

3. What are the ordinary terminations of *abstract* nouns in English? Give examples.

The ordinary terminations of abstract nouns are:—

-age—bondage, herbage, tillage.
-dom—kingdom, serfdom, earldom.
-head, -hood—godhead, childhood, priesthood.
-ness—goodness, hardness, whiteness.
-ship—friendship, hardship, lordship.
-th—length, width, growth, death.
-t—gift, theft, flight, joint.
-ry, -y—finery, chivalry, beggary, roguery.
-lock—wedlock; *ledge*—knowledge.
-ing—reading, hearing, seeing, thinking.

Geography.

(*Answer either Question* 1 *or Question* 2, *not both.*)

1. Draw a map of the southern counties of England, and describe as fully as you can, referring to your map, the water-partings and river basins of these counties.

N.B.—Insert the lines of latitude and longtitude.

All the rivers of southern England have their sources along the lesser line of the water-parting which crosses the island from the Atlantic to the North Sea, and flow northwards to the Thames and Bristol Channel, or southward to the English Channel. (*Refer to map.*)

The first group is formed by the rivers of the Weald, rivers small in size and of no commercial importance. All have the same origin in a line of high ground which crosses the centre of the Weald from east to west. (*Refer to map.*) This line of heights throws down small streams to north and south.

The first cut channels for themselves through the North Downs, and so make their way into the Thames or the German Ocean. Among these are the Mole, Medway, and Stour. The rivers of the southern slopes are of very little consequence. The largest of them is the Ouse, which falls into the English Channel, and further west is the Arun.

A second group is that of the rivers of the South Downs. The plain of Southampton and of the New Forest is enclosed on three sides by chalk uplands, whose waters are thrown down to the English Channel. The Itchen and Test fall into Southampton Water behind the Isle of Wight. To the west of the New Forest is the Avon, navigable for many miles; and the Frome flows in a valley running east and west, and forms at its mouth the inlet of Poole Harbour.

The rivers of Devon and Cornwall form a third group, also of small importance since in this narrow peninsula the distance from the heights where the rivers spring to the sea is so short that no streams of any size can be formed. (*Refer to map.*) The two largest are the Exe and Tamar, flowing south, and the Tawe, the Torridge, and the Parret to the north-west.

2. Say what you know about Cumberland, Perthshire, and County Antrim, and describe as fully as you can the differences between these counties in respect of water-partings and river courses.

Draw a map of one or more of these counties, and insert the lines of latitude and longitude.

Cumberland lies on the north-western shores of England, and stretches from the moors of Northumberland on the east to the Irish Sea on the west. To the north and north-west of it are Scotland and the Solway Frith, and to the south Westmoreland and the district of Furness. The county is composed of three distinct parts: the S.W. is mountainous, containing the greater part of the Cumbrian Hills; the N.E. is formed of the wild and desolate slopes of the Pennine moorlands; and between the two lies a broad and fertile plain—the lower valley of the Eden. The chief mountains are the Scafell Pikes, Scafell, Bowfell, and Skiddaw. The lakes so famous lie in the hilly country between these mountains. The only large river is the Eden; next in size is the Derwent, which with its tributaries drains four lakes. The only industry of the mountainous parts consists of sheep-farming and slate quarrying. On the seacoast the people are employed in coal and iron mining. The chief towns are Carlisle, Penrith, Keswick, Cockermouth, Maryport, Workington, and Whitehaven. The finest plumbago in the world is got at Borrowdale.

Perthshire is a county of Scotland, occupying the border-land between Highlands and Lowlands. The county is about equally divided between the mountains and the plain, and forms an irregular circle almost coinciding with the basin of the Tay. It occupies a most important geographical position, being placed in the very heart of Scotland, and not only including the rich fields of Strathmore, but also every one of the main passes that lead from the south into the centre of the Highlands. Among the mountain ridges are enclosed the greater number of the vast circle of Highland lakes, the whole district forming scenery unrivalled in Britain. The chief towns are Perth, the only really large town, Blairgowrie, Crieff, Dunblane, Comrie. Perthshire is almost entirely an agricultural county.

Antrim is a long, narrow county on the N.W. coast of Ireland; shut in on every side by water, being bounded on the N. and E. by the North Channel, on the W. by Lough Neagh and Bann, and on the S. by the Lagan and Belfast Lough. The population and industry of the county mainly gather round the shores of Belfast Lough, where the linen and cotton manufactures of Ireland centre. The chief towns are Belfast, the second greatest city in Ireland, Carrickfergus, Laggan, and Ballymena.

The water-partings in Cumberland consist of offshoots from the Cumbrian mountains, which form a small, compact, and circular mass, very steep on their northern and western faces, but sinking gradually to Morecambe Bay on the south in long and gentle slopes. In their long, narrow valleys are ranged, in a somewhat regular order round Helvellyn, the centre of the group—those lakes which have given the region the name of the *Lake District*. In Perthshire the water-partings consist of a number of sharply-defined ridges marked by important mountains such as Schiehallion, Ben Lawers, Ben More, which ridges are separated from one another, enclosing lakes or mountain streams, and end abruptly as they reach the plain so as to present the appearance of a barrier

stretching obliquely across it. In Antrim the mountains constitute a broad, high table-land, ending abruptly in precipitous cliffs and broken by steep hills near the sea. On the west they fall gradually to L. Neagh and Bann, which is thus the only watershed of the county.

3. Trace *minutely* the journey of a traveller landing in Nova Scotia and going to British Columbia. Describe in the order in which he would come to them, the physical features of the country he passes through, and the chief towns on his route.

Landing at Halifax, whose fine harbour is the admiration of the world, the traveller may proceed across Nova Scotia through a generally undulating but not mountainous country into New Brunswick, whose surface is varied, its northern part forming a table-land, having upon it numerous ranges of hills and studded with lakes. Its centre part rises gradually from the St. Lawrence towards the interior for a considerable distance. Generally, the natural features of this province are picturesque rather than bold and startling. The capital is Fredericton, a pretty town; but the chief place is St. John, one of the most picturesque and flourishing cities of the North American Provinces. Leaving New Brunswick, the traveller enters the Province of Quebec (formerly Lower or East Canada), which is characterised by picturesque scenery consisting of boundless forests, magnificent rivers and lakes, extensive prairies, and bold, rocky heights. Quebec, the capital, is very strongly fortified, stands on the north bank of the River St. Lawrence, and Montreal, on an island at the confluence of the St. Lawrence and Ottawa; has a thriving trade. The tubular bridge, which carries the Grand Trunk Railway over the St. Lawrence, is one and a quarter miles long. He is now in the Province of Ontario, the surface of which is gently undulating, and diversified with lakes and rivers, the lakes being numerous and magnificent. Proceeding along the route of the Canada Pacific Railway, he traverses the marshy district on the north of the great lakes, and reaches the great prairie land of Manitoba, with its busy capital Winnipeg. Continuing his now wild and inhospitable journey through the prairie region, he follows the valley of the Saskatchewan, and crossing the Rocky Mountains by the Vermillion Pass, which lies between the upper portions of the Southern Saskatchewan and the Kutanie, a tributary of the Columbia, he enters the District of Columbia. The eastern half is very mountainous; but the greatest diversity of soil is met with in this province; lake, mountain, forest, marsh, and prairie frequently alternating.

History.

1. What is told about the Druids? Mention any Druidical remains which you are acquainted with.

The Druids were priests among the ancient Celtic peoples of Britain and Gaul. They seem to have had some knowledge of mathematics and natural philosophy, and superintended the affairs of religion and morality. They venerated the mistletoe when growing on the oak, which was a sacred tree.

In several parts of England there are gigantic ruins supposed to be the remains of Druidical temples, of which the most remarkable are those of Stonehenge on Salisbury Plain, and those at Avebury in Wilts.

2. Who was Canute? What do you gather from about him and the rising tide?

Canute was the son of Sweyn, whom he succeeded on the throne of England in 1014. He was proclaimed king by the Danes in that year, but was not sole king till 1017, when Edmund Ironside, his rival, died. By his conquest of Norway he became king of England, Denmark, Norway and Sweden.

From the story of 'Canute and the tide' we gather he was a man of good sense and superior to the foolish flattery of courtiers. It might be a proof, also, that he really acknowledged the authority of One who is higher than all earthly monarchs.

3. How was Malcolm Canmore of Scotland connected with Edward the Confessor?

Malcolm of Scotland married Margaret, daughter of Edward the Outlaw, nephew of Edward the Confessor.

Composition.

Write from memory the substance of this passage read to you by the Inspector:—

'The Cossacks who live to the north-east of the Caspian Sea are the ugliest race I have yet seen. Their complexion is a dirty white, burnt here and there, as on the nose and cheek-bones, to the colour of raw beef. The cheek-bones are high, the face is either circular or triangular, the lips are thin, the eyes small, ill-formed, ill-coloured, and half opened. The nose is a hideous aquiline, with sprawling nostrils. The men have generally no signs of beard. The smoothness of lip and chin, and the similarity in the attire of the sexes, render it very difficult for a stranger to distinguish them. The head-dress is a bonnet of lamb's or wolf's fur, with the fur inwards. The cloak is generally a skin. The feet are cased in boots of brown leather. The average stature of those Cossacks we have hitherto seen is about five feet three inches.'

Needlework.

FEMALES.

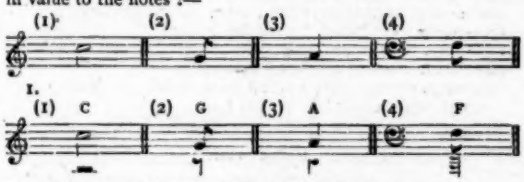
(*One hour allowed for this Exercise.*)

Music.

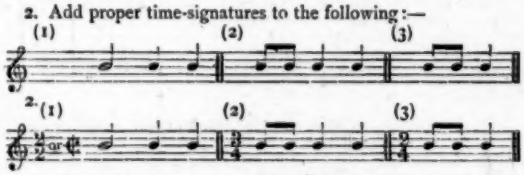
A quarter of an hour allowed for this paper.

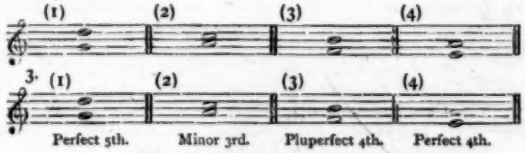
(N.B.—Pupil Teachers may answer the questions in either the Staff Notation or the Tonic Sol-fa, but *not both*. The questions in the Tonic Sol-fa Notation will be found at the end.)

1. Write above each of the following notes its pitch-name (C, D, &c.); and below write the signs for rests corresponding in value to the notes:—



2. Add proper time-signatures to the following:—



3. Write below each of the following intervals its name (major fourth, &c.):—

TONIC SOL-FA NOTATION.

1. Re-write the following, doubling the value of every note:—

|s :f .m |l :— |

1. |s :— |f :m |l :— |— :— |

2. What do "Key G," "Key C," mean at the beginning of a tune?

2. "Key G" means that after sounding the note C[1] on a tuning-fork, we run down the scale to G, which is to be taken as the doh of the tune. "Key C" means that the note sounded in a similar manner is to be taken as the doh of the tune, from which *the* doh is easily obtained.

3. Write the names of the following intervals:—(1) *soh* to *ray*[1]; (2) *lah* to *doh*[1]; (3) *fah* to *te*; (4) *me* to *lah*.

3. (1) Perfect (or Major) 5th; (2) Minor 3rd; (3) Pluperfect 4th; (4) Perfect 4th.

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a half allowed for this Paper.

Euclid.

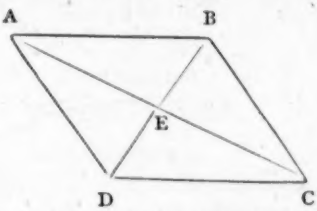
MALES.

[All generally understood abbreviations for *words* may be used.]

1. If two angles of a triangle be equal to each other, the sides also which subtend, or are opposite to the equal angles, shall be equal to one another. Prop. 6, Bk. I.

2. The greater side of every triangle is opposite to the greater angle. Prop. 18, Bk. I.

3. The quadrilateral whose diagonals bisect each other is a parallelogram.



Let the diagonals of the quadrilateral ABCD bisect each other in the point E, then the figure is a parallelogram.

Because AE = EC, and BE = ED, the two sides AE, ED = respectively CE, ED, and ∠AED = ∠BEC; ∴ (I. 4) the △AED = △BEC, the base AD = base BC, and the ∠EAD = ∠ECB, and they are alternate ∠s. ∴ (I. 28) AD is ∥ BC.

In the same way it may be shown that AB is ∥ BC.

∴ the quadrilateral ABCD is a ∥gram. Q. E. D.

Arithmetic.

FEMALES.

1. Add together $\frac{5}{14}$ of a guinea, $\frac{2}{5}$ of a shilling, and $\frac{1}{12}$ of half a crown, and reduce the result to the fraction of £5.

$$\frac{5}{14}\text{ gui.} \quad = \frac{5 \times 21}{14 \times 20} \text{ £} = \frac{1}{4} \text{ £} = \frac{5}{20} \text{ £}$$

$$\frac{2}{5}\text{s.} \quad = \frac{5}{8 \times 20} \text{ £} = \frac{1}{32} \text{ £} = \frac{5}{160} \text{ £}$$

$$\frac{1}{12}\text{ half-cr.} = \frac{1}{12 \times 8} \text{ £} = \frac{1}{96} \text{ £}$$

$$\text{Sum} = \frac{41}{160} \text{ £}$$

∴ £$\frac{41}{160}$ to the fraction of £5 $= \frac{5}{12 \times 5} = \frac{1}{12}$ Ans.

2. Reduce to a decimal $2\frac{1}{2}$ of $2\frac{1}{4}$ of $2\frac{1}{8}$.

$2\frac{1}{2}$ of $2\frac{1}{4}$ of $2\frac{1}{8} = \frac{5}{2} \times \frac{9}{4} \times \frac{17}{8}$

$= \frac{765}{64} = 11{\cdot}953125$. Ans.

3. How many times does $\frac{1}{12}+\frac{1}{4}+\frac{1}{8}$ contain $\frac{1}{3}+\frac{1}{6}+\frac{1}{9}$?

$$(\tfrac{1}{12}+\tfrac{1}{4}+\tfrac{1}{8}) \div (\tfrac{1}{3}+\tfrac{1}{6}+\tfrac{1}{9}) = \frac{2+6+3}{24} \div \frac{6+3+2}{18}$$

$$= \tfrac{11}{24} \div \tfrac{11}{18}$$

$$= \frac{11 \times 18}{24 \times 11} = \frac{3}{4} \text{ Ans.}$$

4. What part of 7 bushels 2 pecks 1 gal. is 1 peck $1\frac{1}{10}$ gal.?

$$\frac{1 \text{ pk. } 1\frac{1}{10} \text{ gal.}}{7 \text{ bushs. } 2 \text{ pks. } 1 \text{ gal.}} = \frac{3\frac{1}{10} \text{ gals.}}{61 \text{ gals.}} = \tfrac{31}{610} \div 61 = \frac{1}{1220} \text{ Ans.}$$

Grammar.

MALES AND FEMALES.

1. 'If you dissemble sometimes your knowledge, you shall be thought another time to know that you know not.'—BACON.

Analyse the above, and parse it.

ANALYSIS.

Sentence.	Kind.	Subj.	Predicate Verb.	Completion.	Extensions.	Connective.
(1) If you dissemble sometimes your knowledge.	Subord. adverb. (*condition*) to (2)	you	dissemble	your knowledge (object)	sometimes (*time*)	if
(2) You shall be thought another time to know that, etc.	Principal	you	shall be thought	to know that, etc. (3)	another time (*time*)	
(3) That you know not.	Subord. noun to (2)	you	know not	that		

PARSING.

If—subord. conj. of condition, connecting 'you dissemble, etc.,' with the principal sentence, 'you shall, etc.'

you—pers. pron., 2nd pers., mas. or fem., plur., nom., subj. of 'dissemble.'

dissemble—reg. trans. verb, subj., pres. indef., 2nd pers., pl., agr. with 'you.'

sometimes—adv. of time, mod. 'dissemble.'

your—pronom. poss. adj., limiting 'knowledge.'

knowledge—abstr. noun, neut., sing., obj., gov. by 'dissemble.'

you—same as above, subj. of 'shall be thought.'

shall be thought—irreg. trans. verb, *think, thought, thought*, pass. voice, indic., future, 2nd pers., plur., agr. with subj. 'you.' (*These words may be parsed separately.*)

another—indef. numeral adj., qual. 'time.'

time—abstr. noun, neut., sing., obj. of time (gov. by such a prep. as 'at.')

to know—irreg. trans. verb, *know, knew, known*, infin., pres. indef., gov. by 'shall be thought.'

that (= what)—rel. pron., neut., sing., 3rd pers., stands as object of 'to know,' and also of 'know not.'

you—same as above, subj. of 'know not.'

know not—irreg. trans. verb (as above), negative form, indic., pres. indef., 2nd pers., plur., agr. with subj. 'you.'

2. What is the prefix in the word 'dissemble'? and mention other *verbs* in which it occurs, sometimes with a modification.

The prefix in *dis*, which also occurs in these verbs—disarm, discern, disturb.

It takes the form *di*, in dilate, diminish, dilute; and is modified in differ, descry, despatch, defy, deluge, and depart.

3. Paraphrase the following lines:—

'The oracles are dumb;
No voice or hideous hum
Runs through the arched roof in words deceiving;
Apollo from his shrine
Can no more divine
With hollow shriek the steep of Delphos leaving.'

The priestess of the Delphic Apollo no longer with ambiguous answers pretends to foretell the fortunes of anxious inquirers. The temple is deserted, for the wonderful mouth-piece of the gods is gone, and the sounds which stood for words are for ever hushed.

Geography.

Answer two questions.

1. Draw a full map of France; and describe, as fully as you can, referring to your map for illustration, the water-partings and river basins of that country.

N.B.—Insert the lines of latitude and longitude.

The mountains and ridges of France run in such directions as to separate the country into three great slopes—the western, the north-eastern, and the south-eastern. The western slope includes the basins of the Adour, the Garonne, the Charente, the Loire, the Vilaine, the Orne, the Seine, the Somme, and a number of less importance. The north-eastern slope comprehends part of the basins of the Scheldt and the Meuse. The south-eastern or Mediterranean slope comprehends the basin of the Rhone, and of one or two unimportant streams. The basin of the Garonne

is included between the Pyrenees and the Auvergne Mountains; that of the Loire between the Auvergne and Cevennes Mountains; the Cotes d'Or Mountains separate the basins of the Seine and Loire from that of the Sâone; the Vosges Mountains separate the Rhine from its affluent, the Moselle; and the Alps form the boundary of the basin of the Rhone, separating it from the Po. These are the principal water-partings, though there are twelve river basins of considerable magnitude.

2. Between what degrees of latitude and of longitude does Great Britain lie? Explain exactly the meaning of this question, and of the terms *degree*, *latitude*, *longitude*; and name the most easterly, the most westerly, the most northerly, and the most southerly places in Great Britain.

Great Britain is situated between lat. 49° 58′ and 58′ 40′ north, and between 1° 45′ E. and 6° 14′ W. longitude.

A degree is the 360th part of a circle, and is divided into 60 minutes. On the earth's surface a degree of a great circle is equal to 69½ miles nearly.

Latitude is the distance of a place measured in degrees, minutes, and seconds north or south from the equator, and measured on the meridian.

Longitude is the distance of a place east or west of the first meridian (in Britain, that of Greenwich), measured on the equator in degrees, etc.

The most easterly point of the mainland of Britain is Lowestoft Ness, in Suffolk; the most westerly, Ardnamurchan Point, in Argyll; the most northerly, Dunnet Head, in Caithness; and the southerly, Lizard Point, in Cornwall.

3. Describe fully the physical features, climate, and productions of British India.

PHYSICAL FEATURES.—The table-land of Tibet, lying immediately to the north of Hindostan, is the loftiest in the world, being probably 12,000 feet high. From it the continent descends by a steep slope to the plain of Hindostan, which has a height of only about 1,000 feet above sea-level. At the foot of the Himalaya Mountains lie a narrow belt of forest land, and a narrow belt of swampy ground, called the Terai (or swamp). Beyond the Terai is the Plain of Hindostan, comprising the basin of the Ganges on the east, the basin of the Indus on the west, and a large track between these two river valleys called the Great Desert. South of the plain the country rises into a table-land, backed by the Vindhya Mountains, at the foot of which is the rich valley of the Nerbudda, extending to the range of the Sautpoora Mountains, south of which is the valley of the Taptee. South of the Taptee rises the table-land of the Deccan sloping towards the east, and rising terrace beyond terrace to the height of 3,000 feet. It is bounded on its eastern and western sides by low mountain chains known as the Ghauts, which approach each other as they run southwards, till at last they meet at the southern end of India. The Ghauts and the Vindhya Mountains thus form the rim of the Deccan. The Aravulli Mountains run from south-west to north-east between the basins of the Ganges and Indus.

THE CLIMATE.—The climate of a large country like India is of necessity very varied. Its proximity to the equator would lead us to conclude that the climate would be tropical and very warm, but no country of equal extent is so much favoured as India. This arises from the physical inequalities of its surface, which prevent the country from being a desert. The Himalayas act as the great modifiers of temperature, and provide proper water supply to the rivers in the north as well as to the atmosphere.

Owing to certain causes, the wind, instead of blowing from all quarters, blows generally for six months in one direction and six months in the other. These are 'monsoons,' and on these the rain of India depends. Certain districts in the south of the Deccan, which are exposed to both winds, have two rainy seasons, one for each monsoon. The year in India admits for the most part of being divided into three seasons—namely, the *hot*, the *wet*, and the *temperate*. During the hot season, on the low plains of the coast and in the plain of the Ganges, the heat is almost unbearable, but on the Deccan, owing to its elevation, the heat is much subdued. The air of the hills is purer and cooler than that of the plains; and therefore the Europeans who suffer from the climate of the plains betake themselves to the hills to recruit their health. The most unhealthy districts are those in which there is swamp or jungle, such as the Terai, the Sunderbunds, and some of the rice grounds on the eastern coast.

PRODUCTIONS.—*Wheat* is grown in the N.W. provinces; *barley* and *millet* in the Nilgiri hills; and *rice*, the principal food of most of the inhabitants along the Lower Ganges. *Cotton* is cultivated in Bengal, Burma, Assam, and Nagpore. *Jute* is cultivated in Bengal, Bombay, and other parts. *Indigo* is the chief product between the the Upper Ganges and the Himalayas. *Opium* grows in the Middle Ganges and in Malwa, forming one of the sources of revenue. *Tea* is produced in Assam, and *coffee* in Ceylon. There are extensive forests, with a great variety of useful *timber* trees, such as bamboo, teak, satin-wood, iron-wood, mulberry, banyan, etc. *Iron* and *coal* are worked near Magpore, in Bengal. *Silver* is found in the jungles of Bengal; *gold* in the Punjaub and on the coast of Malabar; *diamonds* in the central provinces and at Golconda; the mines are now exhausted.

SECOND PAPER.

Needlework.

FEMALES.

(The needlework specimens will be collected by the Inspector at the expiration of one hour after the distribution of the examination papers.)

Arithmetic.

Two hours and a half allowed.

MALES.

1. At what rate per cent., simple interest, will £1760 amount to £2147 4s. in 4 year 146 days?

Interest = £2147 4s. − £1760 = £387 4s.

£1760 : £100
4⅔ yrs. : 1 yr. } :: £387¼ : rate per cent.

$$£387\tfrac{1}{4} \times \frac{100}{1760} \times \frac{1}{4\frac{2}{3}} = \frac{£1936 \times 100 \times 5}{5 \times 1760 \times 22} = \underline{5 \text{ p.c.}} \text{ Ans.}$$

2. If a bank pays 12½ per cent. dividend, and a person pays £12 for a £5 share, what interest will he get for his money?

If a £5 share cost £12, then shares to the value of £100 cost £240.

∴ £240 : £100 :: £12½ : rate of interest.

$$\frac{£12\tfrac{1}{2} \times £100}{240} = \frac{1250}{24} = \underline{5\tfrac{5}{12}}. \text{ Ans.}$$

3. The population of a town increased 8 per cent. from 1871 to 1881, and its population in the latter year was 9720; find its population in 1871.

108 : 100 :: 9720 : population in 1871.

$$\frac{9720 \times 100}{108} = \underline{9000}. \text{ Ans.}$$

4. A railway incline rises 1 foot in 80 in the first ¼ mile, then 1 in 120 in the next 1500 yds., and then 1 in 110 in the next ¼ mile. Find the average rise.

80	¼ ml., or 1320 ft.	::	1 ft.	: 16½
120	1500 ft.	::	1 ft.	: 37½
110	¼ ml., or 2640 ft.	::	1 ft.	: 26
	8460 ft.			78 ft.

It rises 78 ft. in 8460 ft.

" 1 " $\underline{108\tfrac{6}{13}}$. Ans.

History.

MALES AND FEMALES.

1. Who were the Barons? At what period of our history were they most powerful? Give some proofs.

The Barons were tenants-in-chief, who held lands directly from the sovereign on the condition of giving to the sovereign (or suzerain, in feudal language) forty days' military service in each year. The Barons in turn made grants of land to under-tenants, called their 'vassals,' on a like condition of attending their 'lord,' upon a summons to attend the field. The Barons were most powerful under King John and Henry III.; from the former they wrung the rights embodied in Magna Charta (1215), and from the latter they obtained the first outline of our House of Commons (1265).

2. When and where was the Battle of Bosworth fought? What wars did it end, and how?

The Battle of Bosworth was fought in August, 1485, at Market Bosworth, in Leicestershire. This battle ended the sanguinary and shameful civil 'Wars of the Roses' by the death of Richard III., and the triumph of the Earl of Richmond, the representative of the Lancastrian Red Rose. Richmond was crowned as Henry VII., and by his marriage with Elizabeth of York the rival claims were settled and the two lines united.

3. Relate briefly the history of Mary Queen of Scots.

Mary Queen of Scots, was born at Linlithgow in 1542, a few days before the death of her father, James V. The Scottish Parliament—having rejected the proposal to marry Mary to Edward VI., the young king of England—sent her to France in 1548, where she was betrothed to Francis, the dauphin. In 1558 they were married. In December, 1559, Francis died. Queen Mary returned to Scotland in 1561, and opposed the progress of the Reformation with all her power. In 1565 she married Darnley. In 1567 Darnley was killed by the blowing up of the Kirk of Field, and Mary married Bothwell shortly afterwards. She surrendered to the nobles, who had taken up arms against her, at Carberry Hill, and was imprisoned in Lochleven Castle. She escaped from thence in 1568; was defeated at Langside; and fled to England, where she was executed in 1587.

Teaching.

Name six words which children find it difficult to spell correctly, and say how you would help your class to learn them?

Children often feel a difficulty in spelling these six words, namely: *certain*, *separate*, *divide*, *twelfth*, *coming*, *course*. The best way to help the children to learn such words is to keep a list of them in a note-book, and revise them at intervals by giving them out for dictation and oral spelling. The derivation of words will assist those who know something of the language or root from which the word comes. Thus, when they know that 'certain' is from 'certus,' 'separate' from 'separo,' 'divide' from 'dividо,' 'coming' from 'come,' 'course' from 'cursus,' it may prevent these words being written *sertain*, seperate, devide, cumming, and coarse. Such words as *twelfth*, where *f* interchanges with *v*, will allow introduction of a few remarks on the sharp and flat consonants p, b (*e.g.*, *baptism*), d and t (*e.g.*, *passed*, *wrapped*).

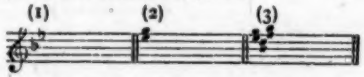
Music.

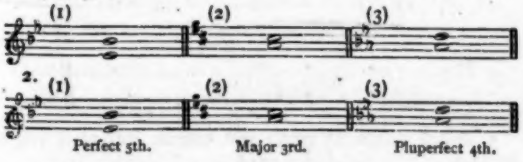
A quarter of an hour allowed for this paper.

(N.B.—Pupil Teachers may answer the questions in either the Staff Notation or the Tonic Sol-fa, but *not both*. The questions in the Tonic Sol-fa Notation will be found at the end.)

1. Write the key-signatures of each of the following major keys:—(1) of B flat; (2) of G; (3) of A.

1. (1) (2) (3)



2. Write below each of the following intervals its name (minor third, &c.):—

3. Add proper time-signatures to the following:—

TONIC SOL-FA NOTATION.

1. What is the mental effect of *soh*; and of *fah*?

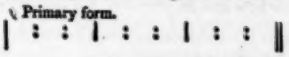
1. *Soh* has a grand or bright effect; *fah* a desolate or awe-inspiring tone.

2. Write the names of the following intervals:—(1) *doh* to *soh*; (2) *soh* to *te*; *fah* to *te*.

2. (1) Perfect (or Major) fifth; (2) Major third; (3) Pluperfect fourth.

3. Write the pulse-signs for nine-pulse measure.

3. Primary form.



THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on or after 1st May, 1878*; **and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Euclid.

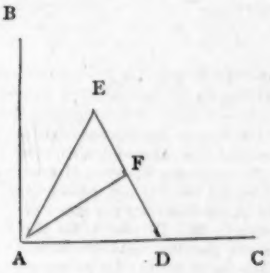
[All generally understood abbreviations for *words* may be used.]

Answer two Questions, including Question 1, if you can.

MALES.

1. Trisect a right angle.

Let BAC be the ∠ right. Upon AD, a part of AC, one of the lines containing the ∠ right, describe an equilateral triangle, each of whose angles (I. 32) = ⅔ of a right angle.



Bisect (I. 9) the angle EAD by the straight line AF. Then BAC is trisected by the straight lines EA, FA.

Because BAC is ∠ right and EAD is ⅔ of ∠ right, then the remaining ∠ BAE is ⅓ ∠ right, and since EAD = ⅔ ∠ right and is bisected by AF, then each of the angles EAF, FAD = ⅓ ∠ right, and hence each of the angles BAE, EAF, FAD is ⅓ ∠ BAC.

Q. E. F.

2. If a straight line falling upon two other straight lines make the exterior angles equal to the interior and opposite upon the same side of the line, or make the interior angles upon the same side together equal to two right angles, the two straight lines shall be parallel to one another.

Prop. 28, Bk. I.

3. Parallelograms upon the same base, and between the same parallels, are equal to one another.

Prop. 35, Bk. I.

Algebra.

Answer two questions.

1. What is the difference between Algebra and Arithmetic? Define *expression*, *term*, *co-efficient*, *index*, with examples. Find the value of

$$\frac{8a^3-27b^3}{4a^2+6ab+9b^2}+\frac{7(a^4-b^4)}{17(a^2-b^2)} \text{ when } a=5,\ b=3.$$

Arithmetic is that branch of mathematics which treats of the properties and relations of numbers.

Algebra may be defined as a kind of universal arithmetic, and is that branch of mathematics in which the operations are carried on by means of letters or other symbols; it establishes the rules of arithmetic and the properties and relations of numbers by *general* reasoning; whereas arithmetic deals only with *particular* cases.

An *expression* is the representation of a quantity by the aid of algebraical symbols as $a+b$, $ab+ac-bc$.

Those parts of an expression which are connected by the signs + or − are called its *terms*; thus a and b are the terms of the binomial expression $a+b$; ab, ac, bc are the terms of the trinomial expression $ab+ac-bc$.

A *co-efficient* is the number, either whole or fractional, which is placed before a quantity as a multiplier. Thus in the expression $5a$, 5 is the co-efficient of a; and in the same way $-5a$ is the co-efficient of xy in the expression $-5axy$, and $-5ax$ the co-efficient of y: so in cd^2y the co-efficient of x is cd^2.

An *index* is a number placed above a quantity to express the power of that quantity or the number which represents how often the quantity is to be repeated in the product; thus a^2 means $a\times a$; x^3 means $x\times x\times x$; 2 and 3 being *indices* or *exponents*.

$$\frac{8a^3-27b^3}{4a^2+6ab+9b^2}+\frac{7(a^4-b^4)}{17(a^2-b^2)}=(2a-3b)+\tfrac{7}{17}(a^2+b^2)$$
$$=10-9+\tfrac{7}{17}(25-9)$$
$$=1+14$$
$$=\underline{15}. \text{ Ans.}$$

2. *Prove* the rule for finding the G.C.M. of two algebraical expressions.

If $x-1$ be the G.C.M. of x^2-2x+r, x^2-3x+s, find r and s.

The proof of the rule for finding the G.C.M. depends on the following principles:—

(*a*) If D divide A, then it will divide mA. For since D divides A, we may suppose A$=a$D, then mA$=ma$D; thus D divides mA.

(*b*) If D divide A and B it will divide mA$\pm n$B. For since D divides A and B, we may suppose A$=a$D, and B$=b$D, then mA$\pm n$B$=(m$A$\pm n$B$)$D; thus D divides mA$\pm n$B.

Let A and B denote the two algebraical expressions, and let them be arranged according to descending powers of some common letter, and suppose the index of the highest power of that letter in A not less than the index of the same letter in B. Divide A by B; let p denote the quotient, and C the remainder. Divide B by C; let q denote the quotient and D the remainder. Divide C by D, and suppose that there is no remainder, and let r denote the quotient. Thus we have the following results:—

B) A (p
pB
C) B (q
qC
D) C (r
rD

$$A=pB+C;\ B=qC+D;\ C=rD.$$

Now, D divides C since C$=r$D; hence by principle (*a*) D also divides qC, and also qC$+$D; that is, D divides B. Again, since D divides B and C, it divides pB$+$C; that is, D divides A. Hence, since D divides A and B, it is a common measure of them. D is not only a common measure, but *the* greatest common measure.

By principle (*b*) given above, every expression which divides A and B divides A$-p$B, that is, C; thus every expression which is a measure of A and B is a measure of B and C. Similarly every expression which is a measure of B and C is a measure of C and D. Thus every expression which is a measure of A and B divides D. But no expression higher than D can divide D. Thus D is the G.C.M.

(*a*)

$x-1)x^2-2x+r(x-1$
x^2-x
$-x+r$
$-x+1$

$\therefore r=\underline{1}$; since if 1 is substituted for r, $x-1$ will measure the expression exactly

$r=\underline{1}$. Ans.

(*b*)

$x-1(x^2-3x+s(x-2$
x^2-x
$-2x+s$
$-2x-2$

$\therefore s=\underline{2}$, for if 2 is substituted for s, $x-1$ will measure the expression exactly

$s=\underline{2}$. Ans.

3. If $x-a=b$, explain clearly how it follows that $x=a+b$.

Solve the equation:—

$$\tfrac{1}{17}(x+9)-\tfrac{5}{85}\{2x-3-4(5x-16)\}=9.$$

(*a*)

3. The fact that if $x-a=b$, then $x=a+b$ is proved from the axiom that '*If equal quantities be added to or subtracted from equal quantities the sums or remainders will be equal.*'

Since $x-a=b$
Add a to each side of the equation. Then
$x-a+a=a+b$
or $x=a+b$

(*b*) $\tfrac{1}{17}(x+9)-\tfrac{5}{85}\{2x-3-4(5x-16)\}=9$

Clearing fractions $332(x+9)-85(2x-3-20x+64)=12699$
,, brackets $332x+2988-170x+255+1700x-5440=12699$
Transposing $332x+1700x-170x=12699+5440-2988-255$
Collecting $1862x=14896$
$x=\underline{8}$. Ans.

Mensuration.

The adjacent sides of a parallelogram are 12 feet and 8 feet, and its area is that of the equilateral triangle described on its longer side; find the perpendicular distance between each pair of opposite sides.

Area of equilateral $\triangle$ $=12^2\times\cdot433$
$=144\times\cdot433$
$=62\cdot352$ sq. ft.
$=$ area of parallelogram.

Now the question is first, to find the side of a rectangle whose area is 62·352 sq. ft. and one side 12 ft.; and second, to find the side of a rectangle of the same area and one side 8 ft.

(1) $\frac{62\cdot352}{12}=\underline{5\cdot196}$ lineal ft. Ans.

(2) $\frac{62\cdot352}{8}=\underline{7\cdot794}$,, Ans.

Arithmetic.

FEMALES.

1. What fraction and what decimal of £5 is £3 17s. 10½d.?

$$\frac{£3\ 17s.\ 10\tfrac{1}{2}d.}{£5}=\frac{1869\text{half-d.}}{2400\text{half-d.}}=\frac{623}{\underline{800}}\text{ V. F. Ans.}$$
$$=\underline{\cdot77875}\text{ Dec. F. Ans.}$$

2. Reduce to a decimal $\frac{3}{4}$ of $\frac{1}{5}$ of $\frac{15\frac{1}{2}}{5\frac{1}{4}}$

$$\tfrac{3}{4}\text{ of }\tfrac{1}{5}\text{ of }\frac{15\frac{1}{2}}{5\frac{1}{4}}=\frac{3\times1}{4\times9}\times(\tfrac{31}{2}\div\tfrac{21}{4})$$
$$=\frac{3\times1\times31\times4}{4\times9\times2\times21}$$
$$=\underline{\tfrac{31}{126}}=\text{·}246031\tfrac{7}{\ }. \text{ Ans.}$$

3. If 8 men *or* 12 boys can dig a ditch in 20 days, how long will three men *and* 5 boys take to do it?

8 men can do as much as 12 boys,
1 man does ,, ,, ,, $1\frac{1}{2}$,,
∴ 3 men do ,, ,, ,, $4\frac{1}{2}$,,
$9\frac{1}{2}$: 12 :: 20 days : time required.

$$\frac{20\text{ days}\times12}{9\frac{1}{2}}=\frac{480}{19}=\underline{25\tfrac{5}{19}}\text{ days. Ans.}$$

4. Express 7 acres 3 roods 28 poles as a decimal of 20 acres.

$$\frac{7\text{ac. }3\text{ro. }28\text{po.}}{20\text{ac.}}=\frac{1268\text{po.}}{320\text{ po.}}=\tfrac{317}{800}=\underline{\cdot39625}. \text{ Ans.}$$

5. Divide 10,000 by ·025; and convert ·045 to a vulgar fraction.

(*a*)

·025)10,000
400,000 Ans.

(*b*)

$\cdot045=\frac{45}{1000}=\underline{\frac{9}{200}}$. Ans.

Grammar.

MALES AND FEMALES.

'Three *times did* they drink,
Upon *agreement*, of swift *Severn's flood*;
Who then, *affrighted* with their bloody *looks*,
Ran fearfully among the trembling reeds,
And *hid* his crisp head in the hollow bank,
Bloo'd-stained with these valiant *combat'ants*.'

HENRY IV., Part I.

Analyse the above, parsing the words in italics.

2. Paraphrase the passage.

3. What sort of word is 'blood-stained'? Give examples of similarly formed words.

4. Point out any suffixes which occur in the lines.

ANALYSIS.

Sentence.	Kind.	Subject.	Predicate.	Object.	Extensions.	Connective.
(1) Three times did they drink, upon agreement, of swift Severn's flood.	Principal	they	did drink of	swift Severn's flood	three times (*time*) upon agreement (*condition*)	
(2) Who then, affrighted with their bloody looks, ran fearfully among the trembling reeds.	Principal	who affrighted ... looks	ran		then (*time*) fearfully (*manner*) among the trembling reeds (*place*)	(*contained in 'who'*)
(3) And (he) hid his crisp head in the hollow bank, blood-stained with these valiant combatants.	Principal	(he)	hid	his crisp head	in the hollow bank blood-stained, etc..... combatants (*place*)	and

Times—abst. noun, neut., sing., obj. of time (gov. by such a prep. as 'at').
did—aux. verb, *do, did*, forming with 'drunk' past tense, indic., 3rd pers., plur., agr. with subj. 'they.'
agreement—abst. noun, neut., sing., obj., gov. by 'upon.'
Severn's—prop. noun, personified, mas., sing., poss, attrib. to 'flood.'
flood—com. noun, neut., sing., obj., gov. by 'of.'
Who—rel. pron., referring to 'Severn,' mas., sing., 3rd pers., nom., subj. of 'ran.'
affrighted—predic. part. adj., qual. 'who.'
looks—abst. noun, neut., plur., obj., gov. by 'with.'
ran—irreg. intrans. verb, *run, ran, run*, indic., past indef., 3rd pers., sing., agr. with 'who.'
hid—irreg. intrans. verb, *hide, hid, hidden*, or *hid*, indic., past indef., 3rd pers., sing., agr. with subj. 'he.'
blood-stained—predic. part. adj., qual. 'bank.'
combatants—com. noun, mas., plur., obj., gov. by 'with'

2. By mutual arrangement, the two men thrice rested and took a draught of water from the Severn, which flowed beside them. As they knelt to drink, the river, from the swiftness of its current, seemed to hurry away, frightened by their gory appearance. In poetic fancy it looked as if hiding among the grass, and under the overhanging bank, which the brave men were saturating with their blood.

3. Blood-stained is a word compounded of a noun and a participle. Other words of a similar kind are: 'chicken-hearted,' 'mop-headed,' 'bed-ridden,' 'heart-broken,' 'rose-tinted,' and 'tip-tilted.'

4. The suffixes are '*ment*' in 'agreement,' '*ed*' in 'affrighted,' *y* in 'bloody,' *ly* in 'fearfully,' *ing* in 'trembling,' and 'ants' in 'combatants.' The 's in Severn's may be considered a suffix.

Geography.

Answer two Questions.

1. Give full notes of a lesson on the Indian Ocean. Draw an outline map in illustration, and refer to it throughout the notes. Insert the lines of longitude and latitude.

N.B.—In framing your notes, give your *chief* attention to the way in which you would place the facts before children. The facts alone, however full, will not count as good 'notes.'

Notes on 'THE INDIAN OCEAN.'

I. BOUNDARIES AND EXTENT.—Separated from the Pacific by Australia and the Asiatic Archipelago, and from the Atlantic by Africa; much smaller than either Pacific or Atlantic; it is a double bay, forcing itself up into the land, bounded on the W. by Africa, on the E. by Malaysia and Australia, and on the N. by Asia; its southern boundary is an imaginary line drawn from C. Agulhas to C. Leeuwin; shaped like an equilateral triangle, the apex of which is intersected by the hugh wedge-like promontory of Hindostan; it is estimated to cover 29,000,000 of square miles; its extreme breadth being upwards of 6,000 miles. (*Explain terms used, and draw from children the shapes of the various parts.*)

II. PARTS.—It pushes into the Asiatic Continent by the two smaller bays of Arabia and Bengal; and still further, by the long narrow inlets of the Persian Gulf and Red Sea; Gulfs of Cambay and Cutch are parts of Arabian Sea, as also G. of Oman, joined to the Persian Gulf by Str. of Ormuz; G. of Aden is joined to the Red Sea by the Str. of Babel-mandeb; Delagoa Ba is the only one of importance on African coast; Str. of Malacca open into the China Sea; Str. of Sunda into Java Sea; Str. of Macassar into Pacific; Palk's Passage is between Ceylon and India; and Channel of Mozambique between Madagascar and Africa. (*Point these on map, and ask class to point them.*)

III. ISLANDS.—Madagascar, off coast of Africa, Bourbon, Mauritius, Rodriguez, Amirante, Seychelles, Comoro; Zanzibar and Socotra; Chagos, Maldives, Laccadives; Ceylon, Andaman, Nicobar, and Mergui Islands; Sumatra, and others of the E. Indies. (*Write these names on B. B., and cause children to pronounce them*)

IV. RIVER SYSTEMS.—*African section*—Zambesi, Limpopo. *Asiatic section*—Euphrates and Tigris, Indus, Nerbudda, etc., in Western India; Ganges, Brahmapootra, Irrawady, and many others falling into the Bay of Bengal; *Australian section*—Rivers of Australia. (*Trace these on map; write and pronounce names as before.*)

V. CHARACTERISTIC NOTES.—Contains many coral reefs. Its most striking feature lies in its periodical winds, called *Monsoons*, which takes the place of the trade-winds of the Atlantic and Pacific, are a great value to navigation, and have a great effect on the climate of India; a great *ocean current* starts from the Bay of Bengal, sweeps past Ceylon, and the Seychelles Is., and between Africa and Madagascar, to the Cape of Good Hope, where it is suddenly checked and turned back to the S.W.; it is exposed to sudden tempests, called *tornadoes*, and *cyclone* waves.

(*Explain winds, and draw from children their notions regarding the use and benefit of these; write and explain names.*

NOTE.—*The above is too long for one lesson, unless the children are already familiar with Southern Asia.*

2. Give a short account of the physical differences between Asia, Africa, and Europe.

N.B.—Give the points which really distinguish each *continent as a whole;* not mere names of mountains, rivers, etc.

Taking the Old World as divided into the three portions of Europe, Asia, and Africa, and comparing them as regards (1) length and indentation of coast-line or seaboard, (2) long, large, navigable rivers, and (3) good climate, we find that Africa has in many parts a poor coast-line, few harbours for its size, and much unhealthy climate. With the exception of the north and the extreme south, the whole of that immense land is given over to barbarism. What might Africa have been if its vast bulk had been pierced by a Mediterranean sea to admit ships and commerce into its interior! Its coast, unfortunately, is singularly free from indentations, and its shores almost destitute of islands. The surface consists of a narrow low-lying seaboard, bounded by lofty mountains running parallel with the coast. Great deserts are a distinctive feature of Africa. Near the Equator are magnificent lakes, recently discovered, forming the long-sought sources of the Nile. The chief rivers of Africa are characterised by periodic inundations, but they are of little commercial value, their navigation being impeded by cataracts, as in the Nile, by shoals, as in the Zambesi, and by pestilential swamps, as in the Niger. From position, configuration, and surface, Africa is naturally the hottest and driest of the continents.

Of the mainland of Asia, India and China are the only fully peopled, industrious, prosperous portions. The reason of this is that China has an indented coast-line, with estuaries and harbours; and both have long, large navigable rivers, and climates which, though not entirely good, are tolerable. On the other hand, Arabia, with a rocky seacoast and no rivers, is a desert. The countries of Central Asia are cut off from the rest of the world by their height and want of connection with the sea, and their severe climate; while the people of the vast plains of Siberia, one-fourth larger than the whole of Europe, watered by three of the noblest rivers in the world, have these advantages

rendered useless by the extreme cold, and are wild and uncivilised, and mainly dependent on hunting, fishing, and other precarious modes of living.

Europe is a happy contrast to all that. In length of coast-line it is far better off than the other continents. No circumstances more favourable to navigation and commerce can be imagined than the deeply-indented coasts of Asia Minor and the Grecian Archipelago (where European commerce first began), Italy, with its double coast-line and its three great adjacent islands, or the equally irregular outline of England, Scotland, and Ireland. We may compare the Japanese Islands with the United Kingdom, the Japanese being the most enlightened and liberal of Eastern Asia. The rivers of Europe, though far behind those of Asia for size, are far before them for convenience and commerce. The Russian rivers are worthy of consideration by themselves for their navigableness, and the flatness of the country which they drain. The climate of Europe escapes extremes. Europe has neither the long droughts nor the violent deluges of rain which afflict Asia and Africa, nor the typhoon winds and cyclone waves which are so destructive. The ocean isolates it from the Polar regions, softens and equalises the temperature of its coasts; the Gulf Stream cherishes and moistens its western shores.

SECOND PAPER.

Two hours and a half allowed.

Needlework.

FEMALES.

(The needlework specimens will be collected by the Inspector at the expiration of one hour after the distribution of the examination papers.)

Arithmetic.

MALES.

1. By selling ale at 2d. per half-pint, a person gains $33\frac{1}{3}$ per cent.; what did the ale cost him per barrel?

No. of half-pints in a barrel $= 36 \times 4 \times 2 \times 2 = 576$.
$\therefore$ Selling price of barrel $= 2\text{d.} \times 576 = 1152\text{d.}$
Hence $133\frac{1}{3} : 100 :: 1152\text{d.}$: prime cost of barrel.

$$\frac{1152\text{d.} \times 100}{133\frac{1}{3}} = \frac{1152\text{d.} \times 100 \times 3}{400} = 864 = \underline{£3\ 12\text{s.}}\ \text{Ans.}$$

2. A person invests £2370 in the 3 per cents. and gets therefrom a dividend of £72; find the price of stock, brokerage being omitted.

£2370 of an investment brings £72, what investment will bring £3?

£72 : £3 :: £2370 : price of stock.

$$\frac{£2370 \times 3}{72} = \underline{98\frac{3}{4}}.\ \text{Ans.}$$

3. Find the square root of ·092416 of $10\frac{9}{16}$ square yards. Express the answer in feet.

(*a*) ·092416 of $10\frac{9}{16}$ sq. yd. $= \frac{·092416 \times 169}{16}$

$= \frac{15·618304}{16}$

$= ·976144$

(*b*)

	·976144	(·988 yd. = <u>2·964 lineal ft.</u> Ans.
	81	
188	1661	
	1504	
1968	15744	
	15744	

4. A man left £30,300 to his 4 sons and 5 daughters, and the share of each son to that of each daughter was to be as $\frac{2}{3} : \frac{1}{2}$. Find the share of each son and of each daughter.

Here the parts $\frac{2}{3}$ and $\frac{1}{2}$ are as 14 : 9.

Hence the sons' shares amount to 14×4 or 56
and the daughters' " " 9×5 or 45
Total shares amount to 101

£ £
$\therefore \frac{56}{101}$ of $30{,}300 = \underline{4200}$, a son's share. Ans.

$\frac{45}{101}$ $= \underline{2700}$, a daughter's share. Ans.

History.

MALES AND FEMALES.

1. What were the Courts of Star Chamber and of High Commission? Why and when were they abolished?

The Court of Star Chamber was presided over by the Chancellor, Treasurer, Lord Privy-Seal, a bishop, and a temporal peer, and exercised jurisdiction over riots, frauds, and other misdemeanours without the aid of a jury. It could inflict any punishment except death.

The Court of High Commission was established in the reign of Elizabeth to try ecclesiastical offences, and enforce the terms of the Acts of Uniformity and Supremacy. It was composed of twelve bishops and thirty-two other members.

Owing to the illegal use made of these Courts by James I. and Charles I., and on account of their inquisitorial style of trial, they were finally abolished by the Long Parliament, 1641.

2. Who was George I., and what was his title to the throne?

George I., Elector of Hanover, became King of England 1714. The descendants of James II. being disinherited by the Revolution of 1688, and George, being the nearest heir, was by the Act of Settlement called to succeed Anne. He was the son of Sophia, daughter of Elizabeth, daughter of James I.

3. What was the Treaty of Amiens? Distinguish between the war with France which preceded this treaty, and that which broke out the next year.

The Treaty of Amiens was concluded in 1802 between Great Britain, France, Spain, and Holland. Its chief terms were that England was to restore all conquests made during the war except Ceylon and Trinidad, that Malta should be given up to Knights of St. John, that Egypt should be restored to Turkey, and that France should give up all claims on Naples and the Papal States.

The war that preceded the treaty was to defeat Napoleon's designs upon India, and was, therefore, fought mainly round Egypt as a centre. The war renewed the next year was to protect Britain from invasion threatened by Napoleon, and generally to check his ambitious and aggressive policy with the countries of Europe.

Teaching.

Write out simple notes of a lesson on *a shilling*, what it is made of, how it is made, and what it is worth.

OBJECTS: *Shilling—sixpence—fourpenny-piece—threepenny-piece—penny—halfpenny—farthing.*

WHAT A SHILLING IS MADE OF: Made of silver (*show colour*)—a metal (*let its ring be heard*)—where got—not found pure—how purified—too soft—small portion of copper mixed with it—this called an alloy. (*Full explanation.*)

HOW IT IS MADE: Silver and alloy molten in a crucible (*explain*)—poured into moulds of fine sand—cooled—stamped with a die (*explain by impression made with a stamp on wax*)—now called a coin (*show it*)—having head of the Queen embossed (*explain*)—date of issue—explain superscription—place where it is coined called the 'Mint.'

WHAT IT IS WORTH: Compare its value with that of the various coins—can exchange it for two sixpences, three fourpences, four threepences, etc.—what articles could be got for a shilling?—how many penny buns could be bought with it?—how many threepenny books? What is the third part of a shilling?—the fourth? etc. Does a shilling always purchase as much at one time as at another? Why does it vary? (*Explain.*)

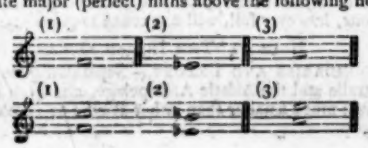
N.B.—Names and new words to be written on blackboard.

Music.

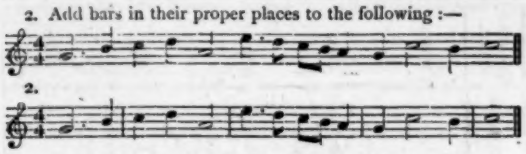
A quarter of an hour allowed for this paper.

(N.B.—Pupil Teachers may answer the questions in either the Staff Notation or the Tonic Sol-fa, but *not both*. The questions in the Tonic Sol-fa Notation will be found at the end.)

1. Write major (perfect) fifths above the following notes:—



2. Add bars in their proper places to the following :—



2.

3. Give (briefly) the meanings of the following terms :—(1) *Allegro* ; (2) *Diminuendo* ; (3) *Dolce*.

3. (1) Merry or lively ; (2) Decreasing in speed and (generally) in intensity ; (3) Sweetly and softly.

TONIC SOL-FA NOTATION.

1. Write major (perfect) fifths above the following :—(1) *fah* ; (2) *me* ; (3) *lah*.

1. (1) *fah* to *doh*^{1} ; (2) *me* to *te* ; (3) *lah* to *me*^{1}.

2. Re-write the following, doubling the value of every note. Use four-pulse measure :—

| d^1 :s .f | m :s .t$_1$ | d :— ‖

2. | d^1 :— | s :-.f | m :— | s :t$_1$ | d :— | — :— ‖

3. What do the following terms mean :—(1) *Allegro* ; (2) *Diminuendo* ; (3) *Dolce*?

3. (1) Merry or lively ; (2) Decreasing in speed and (generally) in intensity ; (3) Sweetly and softly.

FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or after,* 1*st May,* 1878 ; **and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

FIRST PAPER.

Three hours and a half allowed.

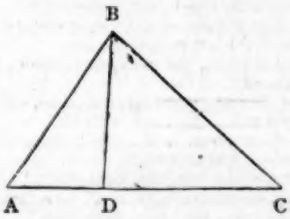
Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

Answer two Questions, including Question 1, *if you can.*

1. From the right angle of a right-angled triangle a perpendicular is drawn on the base. Show that the square on it is equal to the rectangle contained by the segments of the base.



From the ∠ right of Δ ABC let the perp. BD be drawn to the base AC ; then sq. on BD=rect. AD·DC.

Because sq. on AC=sqs. on AB, BC (I. 47)
=sqs. on AD, DB, CD, and DB,
(for sq. on AB=sqs. on AD, DC,
and sq. on BC=sqs. on CD, DB).

Again, sq. on AC=sqs. on AD, DC, and twice rect. AD·DC (II. 4).

But sq. on AC=sqs. on AD, DB, CD, and DB.

∴ Sqs. on AD, DC, and twice rect. AD·DC=sqs. on AD, DC, and twice sq. on DB.

Take away the common sqs. on AD and DC, and
twice rect. AD·DC=twice sq. on DB,
or rect. AD·DC=sq. on DB. (Axiom.)

Q. E. D.

2. If a straight line be divided into any two parts the squares on the whole line and on one of the parts equal to twice the rectangle contained by the whole and that part together with the square on the other part. Prop. 7, Bk. II.

3. To describe a square that shall be equal to a given rectilinear figure. Prop. 14, Bk. II.

Algebra.

MALES.

Answer two Questions.

1. *Prove* that $\frac{a}{b} \div \frac{c}{d} = \frac{ad}{bc}$, where the letters represent any number.

Simplify $\frac{(a-3b)^2}{a^2-9b^2} \div \frac{a^2-2ab-3b^2}{a^2+2ab-3b^2}$

(*a*) Let $\frac{a}{b} = x$, and $\frac{c}{d} = y$

Then $a = bx$, and $c = dy$

∴ Also $ad = bdx$, and $bc = bdy$;

Therefore $\frac{ad}{bc} = \frac{bdx}{bdy} = \frac{x}{y}$; but $\frac{x}{y} = x \div y = \frac{a}{b} \div \frac{c}{d}$,

Therefore $\frac{a}{b} \div \frac{c}{d} = \frac{ad}{bc}$. Q. E. D.

(*b*) $\frac{(a-3b)^2}{a^2-9b^2} \div \frac{a^2-2ab-3b^2}{a^2+2ab-3b^2} =$

$\frac{(a-3b)(a-3b)}{(a-3b)(a+3b)} \div \frac{(a+b)(a-3b}{(a-b)(a-3b)} =$

$\frac{(a-3b)(a-3b)(a-3b)(a-b)}{(a-3b)(a+3b)(a-3b)(a+b)} = \frac{a-b}{a+b}$. Ans.

2. Solve the equations :—

(1) $\frac{4}{17}(x+9) - \frac{3}{13}\{2x-3-4(5x-16)\} = 9$.

(2) $\left.\begin{aligned} \frac{x}{9} + \frac{y}{8} &= 43 \\ \frac{x}{8} + \frac{y}{9} &= 42 \end{aligned}\right\}$

(3) $x - \frac{x^3-8}{x^2+5} = 2$.

(1) $\frac{4}{17}(x+9) - \frac{3}{13}\{2x-3-4(5x-16)\} = 9$

Clearing fractions $332(x+9) - 85(2x-3-20x+64) = 12699$

,, brackets $332x + 2988 - 170x + 255 + 1700x - 5440 = 12699$

Transposing $332x - 1700x - 170x = 12699 + 5440 - 2988 - 255$

Collecting $1862x = 14896$

$x = \underline{8}$. Ans.

(2) $\frac{x}{9} + \frac{y}{8} = 43$; or $8x + 9y = 3096$; or $72x + 81y = 27864$

$\frac{x}{8} + \frac{y}{9} = 42$; or $9x + 8y = 3024$; or $\underline{72x + 64y = 24192}$

By subtracting $17y = 3672$

$y = \underline{216}$. Ans.

Hence by substitution $x = \underline{144}$. Ans.

(3) $x - \frac{x^3-8}{x^2+5} = 2$

$x^3 + 5x - x^3 + 8 = 2x^2 + 10$

Transposing and collecting $2x^2 - 5x = -2$

Dividing by 2 $x^2 - \frac{5}{2}x = -1$

Completing squares $x^2 - \frac{5}{2}x + \frac{25}{16} = \frac{25-16}{16} = \frac{9}{16}$

Taking root $x - \frac{5}{4} = \pm\frac{3}{4}$

$x = \frac{5}{4} \pm \frac{3}{4} = \underline{2}$ or $\frac{1}{2}$. Ans.

3. Form the equation with roots 11 and $\frac{1}{11}$.

Since roots = 11 and $\frac{1}{11}$

Then from the theory of equations

$(x-11)(x-\frac{1}{11}) = 0$

$x^2 - 11x - \frac{1}{11}x + 1 = 0$

$11x^2 - 121x - 1x + 11 = 0$

$\underline{11x^2 - 122x + 1 = 0}$. Ans.

Mensuration.

MALES.

In the figure to Euclid's first proposition the equilateral triangle is ABC, and each side is 7 feet.

(1) Find the difference between the arc AC and the side AC.

(2) Find the area of the space common to the two circles.

(1) The arc AC subtending an angle of 60° is exactly *one-sixth* of the circumference which = diameter $\times 3\frac{1}{7}$ = 14 ft. $\times 3\frac{1}{7}$ = 44 ft.

$\frac{1}{6}$ of 44 ft. = 7 ft. 4 in. length of arc.

Now the chord of arc = 7 ft., therefore the arc is greater than the chord by 4 in. Ans.

(2)

Since angle of sector BAC is 60° then its area $= \frac{14^2 \times \cdot 7854}{6}$

$= \frac{153\cdot 9384}{6}$

$= 25\cdot 6564$ sq. ft.

Deduct area of equilateral $\triangle = 7^2 \times \cdot 433 = 21\cdot 217$,,

and area of *one* common segment = $4\cdot 4394$,,

$\therefore$,, *four* ,, segments = $17\cdot 7576$,,

Add to these the area of

2 equil. $\triangle$s = $21\cdot 217 \times 2 = 42\cdot 434$

and the area of part common to both circles = $60\cdot 1916$,,

Arithmetic.

FEMALES.

1. Out of 10,000 children born in one year 3540 die in the first year. How many per cent. of the number survive?

No. who survived = 10,000 − 3540 = 6460.

$\therefore$ 10,000 : 100 :: 6460 : percentage required.

$\frac{6460 \times 100}{10{,}000} = 64\cdot 6$ or $64\frac{3}{5}$ p. ct. Ans.

2. Divide £1001 10s. in the ratio of 5, 4, 3.

No. of parts = 5 + 4 + 3 = 12.

	£	s.	d.	
$\frac{5}{12}$ of £1001 10s. =	417	5	10	Ans.
$\frac{4}{12}$,, ,, =	333	16	8	Ans.
$\frac{3}{12}$,, ,, =	250	7	6	Ans.

3. If the 3 per cent. consols be at $97\frac{1}{2}$, brokerage $\frac{1}{4}$, find the simple interest of £260 for 2 years.

Here £97½ + ¼ or £97¾ brings £3 in 1 year, or £6 in 2 yrs.

$\therefore$ £97¾ : £260 :: £6 : interest required.

$\frac{£6 \times 260}{97\frac{3}{4}} = \frac{£3120}{195} = £16$. Ans.

4. When money is worth $3\frac{3}{4}$ per cent., what should be the price of the 3 per cents.?

$3\frac{3}{4} : 3 :: £100$: price required.

$\frac{£100 \times 3}{3\frac{3}{4}} = \frac{1200}{15} = 80$. Ans.

5. A bill due 3 months hence is discounted at 4 per cent., and its present value is £1225. What is the amount of the bill?

Interest of £100 for ¼ year at 4 per cent. = £1

Amt. ,, ,, ,, = £101

$\therefore$ 100 : 101 :: 1225 : amount of bill.

$\frac{£1225 \times 101}{100} = £1237\ 5s.$ Ans.

Grammar.

MALES AND FEMALES.

1. 'So where a *ship* well *freighted* with the stores,
The sun *matures* on *India's* spicy shores,
Has *dropped* her anchor and her canvas *furled*,
In some safe haven of the western world,
'*T'were* vain *enquiry* to *what* port she *went*,
The gale informs us, *laden* with the scent.'

COWPER.

Analyse the foregoing lines, parsing the words in italics.

Sentence.	Kind.	Subject.	Predicate.	Object.	Extensions.	Connective.
(1) Where a ship well freighted with the stores has dropped her anchor.	Subord. adv. of 'place.'	a ship well freighted with the stores	has dropped	her anchor		where
(2) And her canvas furled in some safe haven of the western world.	do.	(do.)	(has) furled	her canvas	in some safe .....world (*place*)	do.
(3) (Which) the sun matures on India's spicy shores.	Subord. adj. to 'stores' (1)	the sun	matures	(which)	on India's spicy shores (*place*)	(*which*)
(4) 'Twere vain enquiry to what port she went.	Principal	it (*in apposition with* 5)	were vain enquiry, etc.			
(5) To what port she went.	Subord. noun in app. with 'it'	she	went		to what port (*place*)	
(6) The gale informs us, laden with the scent.	Subord. adv. of 'reason' to (4)	the gale, laden with the scent	informs	us		(for)

PARSING.

So—adv. of manner used independently.

ship—com. noun, neut., sing., nom., subj. of 'has dropped.

freighted—complete part. of reg. intrans. verb 'to freight,' predic. of 'ship.'

matures—reg. trans. verb, indic., pres. indef., 3rd pers., sing., agr. with subj. 'sun.'

India's—prop. noun, neut., sing., poss., attrib. to 'shores.'

dropped—complete part. of reg. trans. verb 'to drop,' forming with 'has' perf. indic. act.

furled—complete part. of reg. trans. verb 'to furl,' forming with ('has') perf. indic. act.

'T=it—indef. pron., 3rd pers., sing., neut., nom., subj. of 'were.'

were—irreg. intrans. verb, *am, was, been*, subj., past. indef., 3rd pers., sing, agr. with 'it.'

enquiry—abstr. noun, neut., sing., nom. after 'were,' in apposition with 'it.'

what—indirect interrog. adj., qual. 'port.'

went—irreg. intrans. verb, *go, went, gone*, indic., past. indef., 3rd pers., sing., agr. with 'she.'

laden—complete part. of reg. and irreg. intrans. verb, *lade, laded, laden*, predic. of 'ga'e.'

2. What is the root of the following words?—Museum, royal, instruction, imperial, exaggerate, patriot, amiable, union.

WORD.	ROOT.	MEANING.
Museum	musa	a muse
royal	roi (rex)	a king
instruction	stru-ere	to lay up
imperial	imper-are	to command
exaggerate	agger-are	to heap up
patriot	pater (patris)	a father
amiable	am are	to love
union	unus (unius)	one

3. How was the English language affected by the Norman Conquest?

Immediately after the Norman Conquest in 1066, French became the language of the Court, of the nobility, of the clergy, of literature, and of all who wished for or sought advancement in Church or State. An old writer says that gentlemen's children were taught French from their cradle, and in the grammar-schools boys were made to construe their Latin into French. Even the lower orders tried to speak French in order to be thought something of. In the Universities Latin or French was ordered to be used. French was employed in the courts of law, and the proceedings of Parliament were recorded in French. The great mass of the people, however, clung to their mother-tongue. While the two races were in process of coalescing, many words of French origin made their way into the spoken and then into the written language. But after the amalgamation of the two races, Norman-French became of less and less importance, and at last ceased to be spoken, the language of the majority prevailing.

Geography.

Answer two Questions.

1. Give notes of a lesson on 'The Planetary System.' Illustrate by a diagram.

Diagram showing the sun in centre, then on concentric circles as nearly as possible at relative distances from the sun, the principal planets, viz., Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Herschel or Uranus, and Neptune.

I. PLANETS: THEIR FORM AND MOTIONS.—Sun and attendant planets (*planao*, I wander) distinct from fixed stars; planets dark bodies, deriving light and heat from the sun, and shining by reflection; each star a sun; planets all globes; have two motions; one like the earth revolving on axis; the other a motion round the sun; both motions from west to east (*compare with the motion of the earth*); their paths round the sun not quite circular, but rather elliptical (*explain by a figure*).

II. THEIR DISTANCES.—Their distances almost beyond our comprehension. Sun 93 millions of miles from the earth; distance of the farthest planet from the sun nearly thirty times as much; fixed stars still further distant.

III. PRIMARY AND SECONDARY PLANETS.—Some planets accompanied by others (for example, the moon moves round the earth); these called *secondary* planets, moons, or satellites (*explain*); the principal called *primary;* name the planets as given in diagram, and explain that the Earth has *one* moon; Mars *two* moons; Jupiter *four;* Saturn *eight;* Uranus *four;* and Neptune *one;* while Saturn has in addition a luminous belt or ring.

IV. COMETS.—From *Coma*, a lock of hair; why? Many comets belong to the planetary system (*children may have seen one*); these comets revolve round the sun, but not in any fixed direction; their paths very eccentric (*explain*), coming very near the sun at one part of their course, then, perhaps, passing far beyond the path of the most distant planets and never returning.

V. METEORS.—Dark bodies, some travelling round the sun, others through space (*give an idea of this*) like the comets; of various sizes; make their appearance as *shooting-stars*, and in other forms.

NOTE.—*Names to be written on B.B., explained, and revised at end of lesson. Children to take notes during the giving of lesson, and hand in results to teacher.*

2. Draw a full map of the United States; and describe, as fully as you can, referring to your map, the water-partings and river basins of that country.

Insert the lines of latitude and longitude.

The Alleghanies or Appalachian Chain extend from the Gulf of St. Lawrence to the State of Alabama, and form the water-parting between the rivers which flow into the Atlantic and the two great basins of the Mississippi and the St. Lawrence.

The Rocky Mountains consist of two, and in some places of three, parallel chains; the two principal ranges being:—1. The Pacific Range, extending from Alaska to the peninsula of California, and forms the water-parting between the Pacific on the west and the Youcon and Rio Colorado on the east. 2. The Rocky Mountain Chain forms a wavy line from the mouth of the Mackenzie in the Arctic Ocean to near Lake Nicaragua in Central America, and separates the basins of the Columbia and Rio Colorado on the west from those of the Missouri, Arkansas, and Rio del Norte on the east.

All the rivers of this part of America belong to three great oceanic basins—viz., those inclining to the Atlantic, to the Gulf of Mexico, and to the Pacific. Besides these we have a continental basin, similar to those of the continents of the Old World—viz., the Great Basin in Utah and Nevada, which contains the Great Salt Lake, and many others which are salt and have no outlet.

The great basin of the Mississippi is bounded on the east by the Alleghanies, and on the west by the Rocky Mountains.

3. What are the chief advantages of this country for trade and commerce?

In what respects have any other countries any advantage over us?

Britain stands unrivalled among nations in the extent of her trade and commerce. By referring to the terrestrial globe it will be seen that London stands almost exactly in the centre of the land surface of the globe. This favourable position is enhanced by the fact that she is physically enabled to prosecute her trade by means of her insular position. In addition to this maritime advantage she enjoys every convenience from her numerous harbours, canals, railways, roads, and navigable rivers, by which her industrial products can be conveyed cheaply and readily to the sea.

Owing to the deep indentations of the eastern coast, the numerous navigable rivers of the interior, the magnificent lakes that skirt the northern frontier, and the vast network of railways which is spread over the country, the commercial facilities of the United States stands, perhaps, unrivalled among the nations, while the actual state of her trade is second only to that of Britain.

SECOND PAPER.

Two hours and a half allowed.

Needlework.

FEMALES.

(The needlework specimens will be collected by the Inspector at the expiration of one hour after the distribution of the examination papers.)

Arithmetic.

MALES.

1. A grocer buys sugar at £1 5s. per cwt., and retails it at 3½d. per lb.; find his gain per cent.

Selling price of 1 cwt. = 112 lbs. @ 3½d. each = 392d.
Buying " " = 25s. = 300d.
Gain on 300d. = 92

300 : 100 :: 92 : gain p.c.

$$\frac{92 \times 100}{300} = 30\tfrac{2}{3} \text{ p.c. Ans.}$$

2. A man who has £32,000 stock in the 3 per cents. sells out at 97½ and reinvests the proceeds in 5 per cent. debentures at 159½. Find the increase in his income, a brokerage of ⅛ per cent. being charged on each transaction.

Price got for 100 in the 3 per cents. = 97½
" paid " " 5 " = 160
∴ 160 : 97½ :: £32,000 : Stock in 5 per cents.

$$\frac{£32{,}000 \times 97\tfrac{1}{2}}{160} = £19{,}500$$

$$\text{2nd income} = \frac{£19{,}500 \times 5}{100} = £975$$

$$\text{1st " } = \frac{£32{,}000 \times 3}{100} = £960$$

Increase of income = £15. Ans.

3. If the discount on a bill of £762 13s. 4d. be £29 6s. 8d., interest being at 6 per cent. per annum, in how many months will the bill be due?

Pres. val. of bill = £762½ − 29½ = £733.

$$\left.\begin{matrix} £ & £ \\ 733 & : & 100 \\ 6 & : & 29\tfrac{1}{2} \end{matrix}\right\} :: 12 \text{ mos. : time required.}$$

$$12 \text{ mos.} \times \frac{100}{733} \times \frac{29\tfrac{1}{2}}{6} = 12 \text{ mos.} \times \tfrac{200}{1466} \times \tfrac{59}{12} = 8 \text{ mos. Ans.}$$

4. If 2 men or 5 boys can do a piece of work in 4 days, how many days will one man and one boy together do the same?

2 men do 5 boys' work.
1 man does $2\frac{1}{2}$,, ,,
1 man's work + 1 boy's work = $3\frac{1}{2}$ boys' work.

∴ $3\frac{1}{2}$ boys' work : 5 boys' work :: 4 days : time required.

$$\frac{4 \text{ days} \times 5}{3\frac{1}{2}} = \frac{40}{7} = 5\frac{5}{7} \text{ days. Ans.}$$

History.

1. In reference to conquest, what difference do you observe in our history between the period which preceded 1066, and that which has followed it? How would you explain the difference?

Before 1066 the Conquest of England was accomplished at various times and by different tribes, after the Romans had to leave Britannia in order to protect their empire from invasion. The Jutes, Angles, and Saxons did not come in sufficient force so as to conquer the country at one blow, but insidiously kept coming until the Britons were driven into Wales and Cornwall. The same remarks apply to the Danes, who occupied the eastern part of England, and gave three kings to the Saxons, who were forced to submit to Danish usurpation till the time of Edward the Confessor.

The Norman Conquest was entirely different from the above. After 1066 England no longer remained isolated from the rest of Europe, but for its own benefit, and to the improvement of mankind, it became connected with the affairs of the Continent. The Anglo-Saxon dynasty was terminated, and a sovereign with great continental possessions sat upon the English throne. By that revolution England acquired that interest and established that influence in the transactions of Europe which have continued till our day.

In the previous conquests the conquerors did not coalesce with the Britons, but followed a policy of extermination, whereas by the amalgamation of the Saxon and Norman races a nation has been formed superior to any the world has ever seen, and its destiny seems to be the final subjugation of the world.

2. Why is our Parliament sometimes called St. Stephen's?

The Parliament is sometimes called St. Stephen's because in the reign of Edward III. St. Stephen's Chapel was set apart for the Commons to hold their debates apart from the Lords. In 1834 it was unfortunately destroyed by fire. Of course, when a gentleman was sent to St. Stephen's it meant that he was elected a Member of Parliament.

3. What are the meaning and the value of trial by jury? On such a trial, what part belongs to the judge, and what to the jury?

Trial by jury is regarded as one of the chief securities of our liberties, and the right to such trial has always been jealously maintained. In our days the jury is composed of men taken from any part of the country; not from the neighbourhood where the matter in question is supposed to have risen. They are not required to know anything of the matter, but they are to hear the statements made by the witnesses an the one side and on the other, to form an opinion as to the truth of those statements, and to give a true verdict according to the evidence laid before them.

In all cases where a jury is employed they alone determine which party has truth upon his side; the judge only expounds the law to the jury, registers their verdict, and upon this verdict bases the judgment which he passes.

When we consider that this is the common practice in all cases where a man's liberty is at stake, or where two men are in dispute, we may conclude that trial by jury is no small security that the decision will be fair, although mistakes may possibly result.

Teaching.

Show how you would teach the rule for *subtraction*, and give an example.

In teaching subtraction, the rule or method usually employed is the one known as the artificial method, and goes upon the principle that the difference of two numbers is the same as the difference of two other numbers equally greater than the two former. In finding the difference between 837 and 648, the 7 units and 2 tens of the top line (minuend), not being sufficiently great to allow the subtraction of the figures under them, are respectively increased by 10 units and 10 tens, and this increase, being equal to 1 ten and 1 hundred, can be added to the lower number in the places of tens and hundreds, as shown in the example. The difference of the two numbers after they are thus equally increased will, according to the principle above stated, be the same as that of the given numbers.

8 hund.	13 tens	17 units
7	5	8
1	8	9

Music.

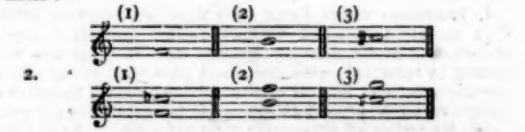
A quarter of an hour allowed for this paper.

(N.B.—Pupil Teachers may answer the questions in either the Staff Notation or the Tonic Sol-fa, but *not both*. The questions in the Tonic Sol-fa Notation will be found at the end.)

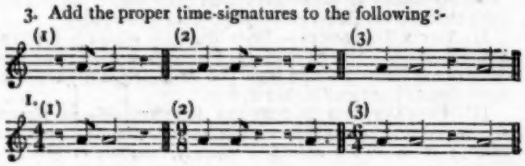
1. Write in the treble clef the ascending scale of C minor, using the minor sixth and the sharpened seventh, placing the necessary flats, &c., before the notes.

1.

2. Write minor or diminished fifths above the following notes :—



3. Add the proper time-signatures to the following :-



TONIC SOL-FA NOTATION.

1. Write the ascending minor scale from *lah*, to *lah*, using the minor sixth and the sharpened seventh.

1. *lah, te, doh ray me fah se lah*

2. Write augmented seconds above the following notes :— (1) *doh* ; (2) *fah* ; (3) *soh*.

2. (1) *doh* to *re* ; (2) *fah* to *se* ; (3) *soh* to *le*.

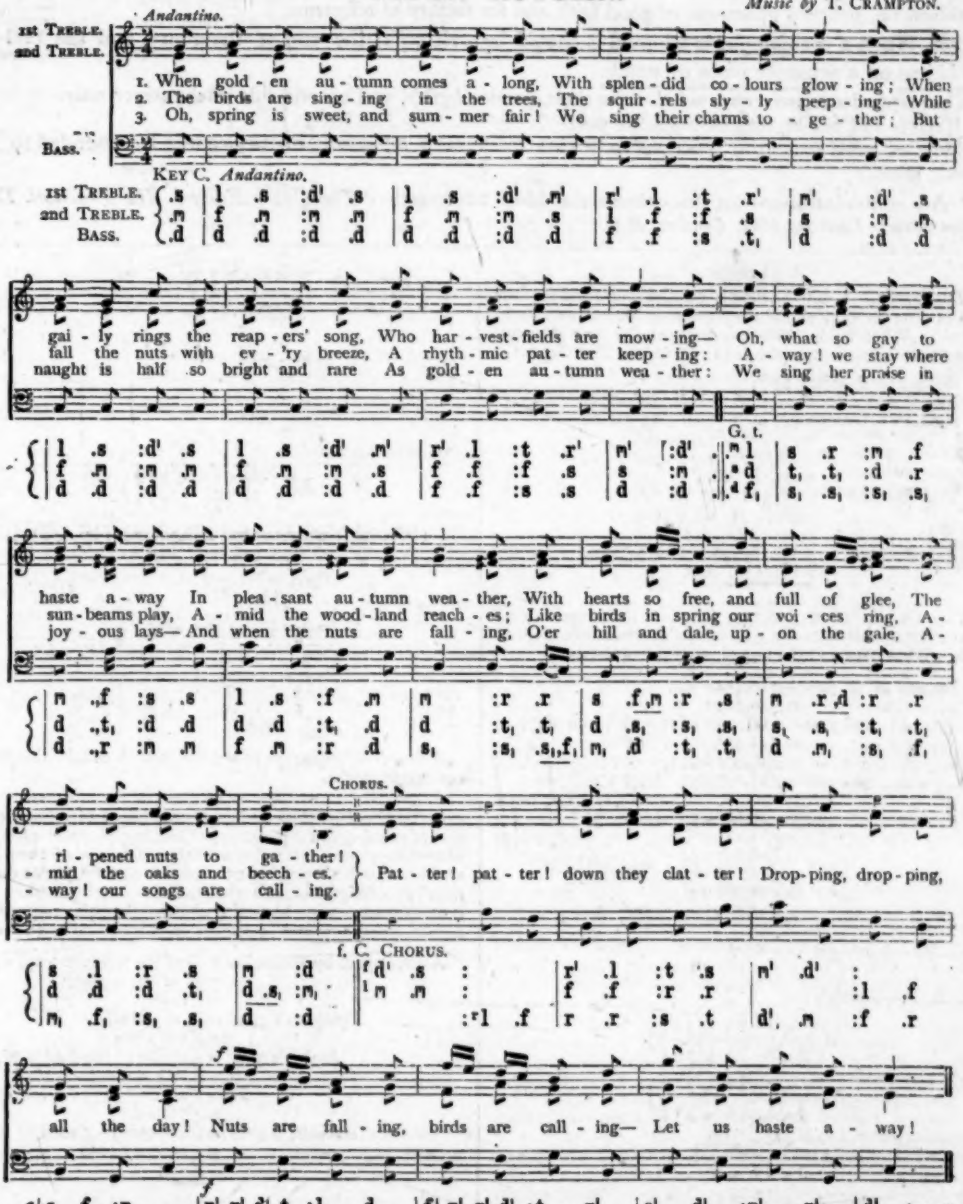
3. Re-write the following, halving the value of every note. Use two-pulse measure :—

|s .l :s |r :— |f :-.n |r .n :d ‖

3. |s,l.s :r |f .n :r,n.d ‖

EFFECT OF OIL ON WAVES.—Some months ago we called the attention of our readers to this subject, which has just received additional light from Captain Urquhart, of the ss. *Cumberland*. While coming from Copenhagen to Leith, with 215 head of cattle on board, a freight necessitating all possible speed, he tried the experiment of hanging bags of oil over the bows of his ship; he found that the oil filtering through upon the waves rendered the sea comparatively smooth, and conduced to a much quicker passage. Such results would seem to justify a series of experiments on the part of high authorities in the interests of commerce and navigation.

GOLDEN AUTUMN.

Music by T. CRAMPTON.

Andantino.
1st Treble.
2nd Treble.
Bass.
1. When gold - en au - tumn comes a - long, With splen - did co - lours glow - ing; When
2. The birds are sing - ing in the trees, The squir - rels sly - ly peep - ing— While
3. Oh, spring is sweet, and sum - mer fair! We sing their charms to - ge - ther; But
KEY C. Andantino.
gai - ly rings the reap - ers' song, Who har - vest - fields are mow - ing— Oh, what so gay to
fall the nuts with ev - 'ry breeze, A rhyth - mic pat - ter keep - ing: A - way! we stay where
naught is half so bright and rare As gold - en au - tumn wea - ther: We sing her praise in
G. t.
haste a - way In plea - sant au - tumn wea - ther, With hearts so free, and full of glee, The
sun - beams play, A - mid the wood - land reach - es; Like birds in spring our voi - ces ring, A -
joy - ous lays— And when the nuts are fall - ing, O'er hill and dale, up - on the gale, A -
Chorus.
ri - pened nuts to ga - ther!
- mid the oaks and beech - es.
- way! our songs are call - ing.
Pat - ter! pat - ter! down they clat - ter! Drop - ping, drop - ping,
f. C. Chorus.
all the day! Nuts are fall - ing, birds are call - ing— Let us haste a - way!

Query Column.

RULES.

1. Each correspondent is restricted to *one question*. We should be much obliged if correspondents, who send questions for solution, would give (if possible) the required answer, and the source from which the question is obtained.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. ☞ **When a pseudonym is adopted it should be written at the end of the query, and the real name and address on a separate piece of paper.**

4. Correspondents are requested to write their queries *legibly*, and on one side of the paper only.

5. Replies will not be sent through the post.

6. Queries must reach the office *not later than the 12th of the month*, or they cannot be attended to in the following issue.

*** All communications for this column should be addressed—'*The Query Editor*,' *The Practical Teacher*, *Pilgrim Street, Ludgate Hill, London, E.C.*

Arithmetic.

1. DISCOUNT.—A bill is drawn on October 22nd for four months of £93 7s 6d., and is discounted on December 12th at 3 per cent. What is the difference between the *true* discount and the *banker's* discount on the bill? (*Analytic Test Cards.*)

Bill is due February 25th.
No of days from Dec. 12th to Feb. 25th = 75.

Banker's discount $= \frac{75}{1460}$ of 3 % on £93 7s. 6d.
$= \frac{5}{1168}$ of £93 7s. 6d.
$=$ £840 7s. 6d. $\div$ 1460
$=$ 11s. $6\frac{344}{1460}$d. ;

True discount $= \frac{5}{1169}$ of £93 7s. 6d.
$=$ £840 7s. 6d. $\div$ 1469
$=$ 11s. $5\frac{1449}{1469}$d. ;

∴ Difference $=$ 11s. $6\frac{344}{1460}$d. − 11s. $5\frac{1449}{1469}$d.
$= \frac{1}{1460} \frac{1}{1469} \frac{1}{1460} \frac{1}{1469}$d. Ans.

2. J. B.—A person has £18,752, for which he is receiving $3\frac{1}{2}$ per cent., but spends annually £27 more than the whole original interest. What has he at the end of 3 years? (*Colenso.*)

Amount at end of 1st year $=$ £18,752 − £27
$=$ £18,725 ;

,, ,, 2nd year $=$ £18,725 − (£27 + $3\frac{1}{2}$ % on £27)
$=$ £18,725 − £27·945
$=$ £18,697·055 ;

,, ,, 3rd year $=$ £18,697·055 − {£27 + $3\frac{1}{2}$ % on (£27 + £27·945)}
$=$ £18,697·055 − (£27 + $3\frac{1}{2}$ % on £54·945)
$=$ £18,697·055 − (£27 + £1·923075)
$=$ £18,697·055 − £28·923075
$=$ £18,668·131925
$=$ £18,668 2s. $7\frac{8}{1000}$d. Ans.

Note.—Your writing is *very fair.*

3. R. B. P.—Simplify :—

$$\frac{7}{12}\left(\frac{\sqrt{2-\frac{1}{2}}\times\sqrt{3+\frac{1}{3}}}{3\sqrt{2-\frac{1}{2}}\div\sqrt{3+\frac{1}{3}}}\right).$$

$$\frac{7}{12}\left(\frac{\sqrt{2-\frac{1}{2}}\times\sqrt{3+\frac{1}{3}}}{3\sqrt{2-\frac{1}{2}}\div\sqrt{3+\frac{1}{3}}}\right)$$

$$=\frac{7}{12}\left(\frac{\sqrt{\frac{3}{2}}\times\sqrt{\frac{10}{3}}}{3\sqrt{\frac{3}{2}}\div\sqrt{\frac{10}{3}}}\right)$$

$$=\frac{7}{12}\left(\frac{\sqrt{\frac{3}{2}}\times\frac{10}{3}}{3\sqrt{\frac{3}{2}}\div\frac{10}{3}}\right)$$

$$=\frac{7}{12}\left(\frac{\sqrt{5}}{3\sqrt{\frac{3}{2}}\times\frac{7}{10}}\right)$$

$$=\frac{7}{12}\times\frac{\sqrt{5}}{3\sqrt{\frac{15}{14}}}$$

$$=\frac{7}{12}\times\frac{1}{3}\times\frac{\sqrt{5}}{\sqrt{\frac{15}{14}}}$$

$$=\frac{7}{42}\times\sqrt{5\div\frac{15}{14}}$$

$$=\frac{7}{42}\times\sqrt{5\times\frac{14}{15}}$$

$$=\frac{7}{42}\times\sqrt{\frac{70}{15}}$$

$$=\frac{7}{42}\times\frac{\sqrt{70}}{\sqrt{15}}$$

$$=\frac{\cancel{7}}{\cancel{42}}\times\frac{\cancel{\sqrt{70}}}{\cancel{\sqrt{15}}}$$

$$=\frac{1}{9}. \text{ Ans.}$$

Another method—

$$\frac{7}{12}\left(\frac{\sqrt{2-\frac{1}{2}}\times\sqrt{3+\frac{1}{3}}}{3\sqrt{2-\frac{1}{2}}\div\sqrt{3\times\frac{1}{3}}}\right)$$

(Dividing Numerator and Denominator by $\sqrt{2-\frac{1}{2}}$)

$$=\frac{7}{12}\left(\frac{\sqrt{3\frac{1}{3}}}{3\div\sqrt{3\frac{1}{3}}}\right)$$

$$=\frac{7}{12}\times\frac{1}{3}\times\sqrt{3\frac{1}{3}}\times\sqrt{3\frac{1}{3}}$$

$$=\frac{\cancel{7}}{\cancel{42}}\times\frac{1}{3}\times\frac{\cancel{14}}{\cancel{7}}$$

$$=\frac{1}{9}. \text{ Ans.}$$

Note.—We believe your writing would obtain the *full* percentage of marks.

4. T. D.—Five thousand copies are issued of a 6s. book ; the cost of printing is 1s. per copy, of binding 4d., and of carriage, advertising, etc., 2d. ; the publisher disposes of them to the retail bookseller, charging 25 copies as 24, and 30 per cent. less than the selling price, and upon the whole receipts takes 10 per cent. commission for himself ; what are the gains respectively of author, publisher, and bookseller on this edition? (*Colenso.*)

Amount paid by bookseller $= \frac{7}{10}$ of [6s. × {(5000 ÷ 25) × 24}]
$= \frac{7}{10}$ of (6s. × 4800)
$=$ £1008 ;

Publisher's gain $= \frac{1}{10}$ of £1008
$=$ £100 16s. ;

Author's gain $=$ £1008 − [$\frac{1}{2}$ (1s. + 4d. + 2d.) × 5000} + £100 16s.]
$=$ £10 8 − (£375 + £100 16s.)
$=$ £532 4s. ;

Bookseller's gain $=$ (6s. × 5000) − £1008
$=$ £1500 − £1008
$=$ £492.

5. A. C.—A steward receives for his landlord £1987 of rent, and disburses one-fifth ; he pays his landlord £195 12s., and the remainder is invested in an estate of 30 years' purchase ; find the rent of the estate. (*Colenso.*)

Amount paid for estate $= \frac{4}{5}$ of £1987 − £195 12s.
$=$ £1589 12s. − £195 12s.
$=$ £1394 ;

∴ Rent of estate $=$ £1394 ÷ 30
$=$ £46 9s. 4d. Ans.

Note.—'30 years' purchase' means that it may be purchased for 30 years' rent.

6. WELLINGTON.—A and B go to bed at the same hour daily, but A rises at ¼ past 6, and B at 8; how much of waking life will A have had more than B in 40 years, paying attention to the leap-years?

Time $= (8 - 6\frac{1}{4})$ hrs. $\times \{(365 \times 40) + 10\}$
$= 1\frac{3}{4}$ hrs. $\times$ 14,610
$= 25{,}567\frac{1}{2}$ hrs.
$= 1065$ days $7\frac{1}{2}$ hrs.
$=$ 2 years 335 days $7\frac{1}{2}$ hrs. Ans.

Note.—You did not state the No. of years in your previous communication, and this we mentioned in our issue for October. See reply to 'Julius Cæsar' in General Queries.

7. LAKELAND.—A mixture of 49 gallons of wine (at 15s.) and brandy (at 18s) contains only 1 gallon of brandy; how much water should be added to it that it may contain in each 49 gallons ·2 of a gallon of brandy, and what should be the price per gallon of the whole mixture? (*Hughes's* 'Pupil Teacher Examination Questions.')

49 gals. of mixture contain 1 gal. of brandy;
If ,, ,, ,, ,, $\frac{1}{5}$,, ,, ,, ,,
∴ There are (49×5) gals. $= 245$ gals. in mixture;
Quantity of wine $= (48 \times 5)$ gals. $= 240$ gals.,
,, ,, brandy $= 1$ gal.,
∴ ,, ,, water $=$ 4 gals. Ans.

Price per gal. of the whole mixture
$= \{(15\text{s.} \times 240) + 18\text{s.}\} \div 245$
$= £180\ 18\text{s.} \div 245$
$=$ 14s. $9\frac{51}{245}$d. Ans.

Note.—(1) Your writing is *pretty good*. We cannot state what percentage of marks your writing will obtain at the Scholarship Examination. (2) The Scholarship Questions will be published shortly.

8. JOSEPH EDWARDS.—The specific gravities or relative weights of proof-spirit and water may be taken as 923 and 1,000, disregarding temperature. From a gallon jar filled with proof-spirit, a certain quantity is drawn off, and the jar is then filled up with water. The specific gravity is then found to be 992. How much spirit has been abstracted? (*Johnston's* 'Excise Guide.')

Quantity abstracted $\times$ 1,000 + (1 gal. − quantity abstracted) $\times$ 923
$=$ 1 gal. $\times$ 992,
1,000 times quantity abstracted + 923 gals. − 923 times quantity abstracted $=$ 992 gals.,
(1,000 − 923) times quantity abstracted $= (992 - 923)$ gals.,
77 times quantity abstracted $=$ 69 gals.,
∴ Quantity abstracted $= \frac{69}{77}$ gal. Ans.

9. W. POTTER.—A piece of work can be done by A and B together in 14 hours, or by B and C in $10\frac{1}{2}$ hours, or by A and C in 12 hours. In what time could each person do it by himself? (*Colenso.*)

A and B can do the work in 14 hours,
B and C ,, ,, $10\frac{1}{2}$,, ,
A and C ,, ,, 12 ,, ;
∴ A and B can do in 1 hour $\frac{1}{14}$ of the work,
B and C ,, ,, $\frac{2}{21}$,,
A and C ,, ,, $\frac{1}{12}$,, ;
∴ (By addition)

2 (A, B, and C) can do in 1 hour $\frac{1}{14} + \frac{2}{21} + \frac{1}{12}$ of the work
$= \frac{6+8+7}{84}$,,
$= \frac{21}{84}$,,
$= \frac{1}{4}$,,
∴ A, B, and C can do in 1 hour $(\frac{1}{4} \div 2)$ of the work $= \frac{1}{8}$ of the work;

∴ A can do in 1 hour $(\frac{1}{8} - \frac{2}{21})$ of the work
$= \frac{21 - 16}{168}$,,
$= \frac{5}{168}$,, ,
B ,, ,, $(\frac{1}{8} - \frac{1}{12})$,,
$= \frac{3-2}{24}$,,
$= \frac{1}{24}$,, ,
C ,, ,, $(\frac{1}{8} - \frac{1}{14})$,,
$= \frac{7-4}{56}$,,
$= \frac{3}{56}$,, ;

∴ A can do the work in $1\frac{5}{8}$ hrs. $= 33\frac{1}{3}$ hrs.,
B ,, ,, 24 hrs.,
C ,, ,, $\frac{56}{3}$ hrs. $=$ 18⅔ hrs.

10. ANXIOUS.—Find the amount of £6,250 in 3 years at $2\frac{1}{2}$ per cent. compound interest (neglecting fractions of a penny). (*May Examination for Assistants of Excise.*)

	£	s.	d.
	6,250	0	0
$2\frac{1}{2}\% = \frac{1}{40} =$	156	5	0
	6,406	5	0
$\frac{1}{40} =$	160	3	1
	6,566	8	1
$\frac{1}{40} =$	164	3	2
	£6,730	11	3 Ans.

Note.—Your writing is *very good*, and we believe that it would obtain the *full* percentage of marks at a Civil Service Examination.

11. NIL DESPERANDUM.—A person buys 4 railway tickets to go 60 miles. Two were for 1st class, one for the 2nd, and the fourth a half 1st class for a child. The cost of a 2nd class ticket was ⅔ of that of the 1st class, and the whole sum was £1 11s. 8d. Find the cost of each ticket, and the rate per mile for 1st class. (*Barnard Smith.*)

Cost of a 1st class ticket $\times 2 + \frac{2}{3}$ cost of a 1st class ticket $+ \frac{1}{2}$ cost of a 1st class ticket $=$ £1 11s. 8d.,
Cost of a 1st class ticket $\times (2 + \frac{2}{3} + \frac{1}{2}) =$ £1 11s. 8d.,
Cost of a 1st class ticket $\times 3\frac{1}{6} =$ £1 11s. 8d.,
∴ Cost of a 1st class ticket $=$ £1 11s. 8d. $\div 3\frac{1}{6}$
$=$ £1 11s. 8d. $\times \frac{6}{19}$
$=$ £9 10s. $\div 19$
$=$ 10s.

Cost of a 2nd class ticket $= \frac{2}{3}$ of 10s.
$=$ 6s. 8d.

Rate per mile for 1st class $=$ 10s. $\div 60$
$=$ 2d.

Note.—(1) We think your writing would obtain *full* marks at the Scholarship Exam., as it is *very good*. We recommend the handwriting desired by your master. (2) *Morell's* 'Grammar,' *Dickinson's* 'History of the English Language' (3d.), *Angus's* 'Handbook of the English Tongue.'

12. P. T.—I sold an amount of railway stock at 104, and invested the proceeds in the 3 per cents. at 91; I then sold the 3 per cent. stock at 95, and re-purchasing the railway stock at 105 I found myself a gainer of £50 by the whole transaction. Required the amount of railway stock. (*Colenso.*)

£100 railway stock is sold for £104;
Amount realised by investing this in the 3 per cent. stock
$= \frac{104 \times 95}{91}$ £
$= \frac{760}{7}$ £
$=$ £108⅔;
Gain after re-purchasing £100 railway stock
$=$ £108⅔ − £105
$=$ £3⅔;

$\frac{£}{\frac{7}{25}} : \frac{£}{\frac{25}{2}} :: \frac{£}{100}$: Amount of railway stock.

$=$ £1,400. Ans.

13. RALPH.—In what proportion must wines of 15s., 20s., 26s., and 30s. a gallon respectively be mixed, so as to give a profit of 14⅔ per cent. on the cost price when sold for 24s. a gallon? (*Civil Service Exam.*, Dec., 1875.)

$\frac{£}{\frac{7}{300}} : \frac{s.}{3} :: \frac{£}{132}$: Cost price of mixture.

$=$ 21s.

Difference between cost price of mixture and 1st kind
$= 21s. - 15s.$
$= 6s.,$
" " " 2nd kind
$= 21s. - 20s.$
$= 1s.,$
" " " 3rd kind
$= 26s. - 21s.$
$= 5s.,$
" " " 4th kind
$= 30s. - 21s.$
$= 9s.;$

$\therefore$ Quantity of 1st and 2nd kinds : Quantity of 3rd and 4th kinds
$:: 5s. + 9s. : 6s. + 1s.$
$:: 14s. : 7s.$
$:: 2 : 1.$

$\therefore$ Proportion $= 2$ gals. at 15s., 2 " " 20s., 1 " " 26s., 1 " " 30s.

Note.—Your *specimen* of writing is very good indeed, but if it be judged by your ordinary style we think that you will not obtain full marks. While your specimen writing is almost faultless, the other is too small and too hurried.

14. FIDUS ACHATES.—If the $3\frac{1}{2}$ per cents. paying half-yearly dividends on 1st October and 1st April are 105 on 1st August, what should be the price of the 3 per cents. same day, which pay dividends on 1st July and 1st January? (*Civil Service Arithmetic.*)

Value of $3\frac{1}{2}$ per cents. on 1st August without dividend
$= £105 - \frac{1}{2}$ of $£3\frac{1}{2}$
$= £105 - £1\frac{3}{4}$
$= £103\frac{1}{4}$;

Value of 3 per cents. on 1st August without dividend
$$= £103\tfrac{1}{4} \times \frac{3}{3\frac{1}{2}}$$
$$= \left(\frac{\overset{89}{\cancel{206}}}{\cancel{8}} \times \frac{\cancel{8}}{7}\right) £$$
$= £89;$

Value of 3 per cents. on 1st August with dividend
$= £89 + \frac{1}{4}$ of $£3$
$= £89\frac{3}{4}$. Ans.

Algebra.

1. PUESTA.—Simplify $\dfrac{1}{\sqrt{(5+\sqrt{24})}}$. (*Todhunter.*)

Let, $\sqrt{(5+\sqrt{24})} = \sqrt{x} + \sqrt{y}$
Then, $\sqrt{(5-\sqrt{24})} = \sqrt{x} - \sqrt{y}$
Multiplying, $\sqrt{25-24} = x - y$
$\therefore \underline{x - y = 1.}$

Squaring, $5 + \sqrt{24} = x + y + 2\sqrt{xy}$
$\therefore \underline{x + y = 5.}$
$x + y = 5$
$x - y = 1$
$\therefore \underline{x = 3, \text{ and } y = 2.}$
$\therefore \sqrt{(5+\sqrt{24})} = \sqrt{3} + \sqrt{2}.$

$$\frac{1}{\sqrt{(5+\sqrt{24})}}$$
$$= \frac{1}{\sqrt{3}+\sqrt{2}}$$
$$= \frac{\sqrt{3}-\sqrt{2}}{(\sqrt{3}+\sqrt{2})(\sqrt{3}-\sqrt{2})}$$
$= \sqrt{3} - \sqrt{2}.$ Ans.

2. INQUISITIVE.—A gentleman's age at marriage is double that of the lady's; had the marriage taken place seventeen years earlier, the ratio of the ages would have been *three* to *one*. Find ages of bride and bridegroom. (*Edinburgh University*, 1882-3.)

Let x = gentleman's age,
Then, $\frac{x}{2}$ = lady's " ;
$\therefore x - 17 = 3(\frac{x}{2} - 17)$
$= \frac{3x}{2} - 51$
$x - \frac{3x}{2} = 17 - 51$
$-\frac{x}{2} = -34$
$\therefore \underline{x = 68.}$
$\therefore$ Bridegroom's age $= 68$ years,
Bride's " $= 34$ "

3. POSTCARD.—Solve :—
$$\frac{2}{x^2+2x-2} + \frac{3}{x^2-2x+3} = \frac{x}{2}$$
$$\frac{2}{x^2+2x-2} + \frac{3}{x^2-2x+3} = \frac{x}{2}$$
$$\frac{2x^2-4x+6+3x^2+6x-6}{x^4-3x^2+10x-6} = \frac{x}{2}$$
$$\frac{5x^2+2x}{x^4-3x^2+10x-6} = \frac{x}{2}$$
$$\frac{5x+2}{x^4-3x^2+10x-6} = \frac{1}{2}$$
$$x^4 - 3x^2 + 10x - 6 = 10x + 4$$
$$x^4 - 3x^2 = 10$$
$$x^4 - 3x^2 + (\tfrac{3}{2})^2 = 10 + \tfrac{9}{4}$$
$$= \tfrac{49}{4}$$
$$x^2 - \tfrac{3}{2} = \pm\tfrac{7}{2}$$
$$x^2 = \pm\tfrac{7}{2} + \tfrac{3}{2}$$
$= 5$, or -2
$\therefore \underline{x = \pm\sqrt{5}.}$
$\therefore \underline{x = 0, \text{ or } \pm\sqrt{5}.}$

4. ATTIA.—A man has £100 in sovereigns, half-crowns, and shillings; the weight of the coins is 235 oz., and the number of coins is 852. How many has he of each?
(Assume that a sovereign weighs $\frac{1}{4}$ oz., a half-crown $\frac{1}{2}$ oz., and a shilling $\frac{1}{5}$ oz.) (*Matriculation*, January, 1883.)

Let x, y, z = No. of sovereigns, half-crowns, and shillings respectively;

Then,
$$(1)\quad x + y + z = 852$$
$$(2)\quad \frac{x}{4} + \frac{y}{2} + \frac{z}{5} = 235$$
$$(3)\quad x + \frac{y}{8} + \frac{z}{20} = 100$$

$$(1)\quad x + y + z = 852$$
$$(2)\quad 5x + 10y + 4z = 4700$$
$$(3)\quad 40x + 5y + 2z = 4000$$
$$(1)\quad 4x + 4y + 4z = 3408$$
$$(2)\quad 5x + 10y + 4z = 4700$$
$$x + 6y = 1292 \quad (4)$$
$$(1)\quad 2x + 2y + 2z = 1704$$
$$(3)\quad 40x + 5y + 2z = 4000$$
$$38x + 3y = 2296 \quad (5)$$
$$(4)\quad x + 6y = 1292$$
$$(5)\quad 76x + 6y = 4592$$
$$75x = 3000$$
$$\therefore \underline{x = 44.}$$
$$(4)\quad x + 6y = 1292$$
$$6y = 1292 - 44$$
$$= 1248$$
$$\therefore \underline{y = 208.}$$
$$(1)\quad x + y + z = 852$$
$$z = 852 - (44 + 208)$$
$$= 852 - 252$$
$$\therefore \underline{z = 600.}$$

$\therefore$ No. of sovereigns = 44
,, half-crowns = 208
,, shillings = 600
} Ans.

5. CRUICKSHANK.—A man possesses a fortune of £1000, which he places out at interest at 5 per cent. per annum. He lives at the rate of £100 a year. How long before all is spent?

Let A denote the yearly expenditure, n the No. of years, R the amount of £1 in 1 year, and P the present amount.

$$\text{Then, } P=\frac{A(1-R^{-n})}{R-1};$$

$$\therefore\ 1000=\frac{100\{1-(\frac{21}{20})^{-n}\}}{\frac{21}{20}-1}$$

$$10=\frac{1-(\frac{20}{21})^{n}}{\frac{1}{20}}$$

$$\tfrac{1}{2}=1-(\tfrac{20}{21})^{n}$$

$$(\tfrac{20}{21})^{n}=\tfrac{1}{2}$$

$$\therefore\ n=\frac{\log.\ 1-\log.\ 2}{\log.\ 20-\log.\ 21}$$

$$=\frac{\log.\ 2-\log.\ 1}{\log.\ 21-\log.\ 20}$$

$$=\frac{\cdot30103-0}{1\cdot3222193-1\cdot30103}$$

$$=\frac{\cdot30103}{\cdot0211893}$$

$$=14\cdot206\ldots\ldots$$

$\therefore$ The fortune will be spent in about $14\frac{1}{5}$ years.

6. ROGO.—Solve :—

$$\left.\begin{aligned}x^2&=ax+by\\y^2&=ay+bx\end{aligned}\right\}\ (\textit{Todhunter.})$$

$$\left.\begin{aligned}(1)\ x^2&=ax+by\\(2)\ y^2&=ay+bx\end{aligned}\right\}$$

Subtracting, $x^2-y^2=a(x-y)-b(x-y)$

Dividing by $(x-y)$ $\Big\}$ $x+y=a-b$

$$\therefore\ y=a-b-x.$$

$$(1)\quad x^2=ax+by$$
$$=ax+b(a-b-x)$$
$$=ax+ab-b^2-bx$$
$$x^2-ax+bx=ab-b^2$$
$$x^2-(a-b)x=ab-b^2$$
$$x^2-(a-b)x+\left(\frac{a-b}{2}\right)^2=ab-b^2+\frac{a^2-2ab+b^2}{4}$$
$$=\frac{4ab-4b^2+a^2-2ab+b^2}{4}$$
$$=\frac{a^2+2ab-3b^2}{4}$$
$$=\frac{(a+3b)(a-b)}{4}$$
$$x-\frac{a-b}{2}=\frac{\pm\sqrt{(a+3b)(a-b)}}{2}$$
$$\therefore\ x=\frac{a-b\pm\sqrt{(a+3b)(a-b)}}{2}.$$

$$y=a-b-x$$
$$=a-b-\frac{a-b\pm\sqrt{(a+3b)(a-b)}}{2}$$
$$=\frac{a-b\mp\sqrt{(a+3b)(a-b)}}{2}.$$

Also, as we divided by $(x-y)$,
$$x-y=0$$
$$\therefore\ x=y.$$

Substituting in (1),
$$x^2=ax+bx$$
Dividing by x, $\therefore\ x=a+b.$

And as we divided by x, $\therefore\ x=0$.

$$\therefore\ x=0,\ a+b,\ \frac{a-b\pm\sqrt{(a+3b)(a-b)}}{2};$$

$$y=0,\ a+b,\ \frac{a-b\mp\sqrt{(a+3b)(a-b)}}{2}.$$

Note.—*Roscoe's* 'Lessons in Elementary Chemistry,' 4s. 6d. (Macmillan).

7. J. W.—Solve :—

$$x^2+\sqrt{x^2-5x+1}=5x+1.$$
$$x^2+\sqrt{x^2-5x+1}=5x+1$$
$$x^2-5x+\sqrt{x^2-5x+1}=1$$
$$(x^2-5x+1)+\sqrt{x^2-5x+1}=2$$
$$(x^2-5x+1)+\sqrt{x^2-5x+1}+(\tfrac{1}{2})^2=2+\tfrac{1}{4}$$
$$=\tfrac{9}{4}$$
$$\sqrt{x^2-5x+1}+\tfrac{1}{2}=\pm\tfrac{3}{2}$$
$$\sqrt{x^2-5x+1}=\pm\tfrac{3}{2}-\tfrac{1}{2}$$
$$=1,\text{ or }-2$$
$$x^2-5x+1=1,\text{ or }4.$$

$$x^2-5x+1=1$$
$$x^2-5x=0$$
$$x^2=5x$$
$$\therefore\ x=5.$$

As we divided by x, $\therefore\ x=0$,

Again, $x^2-5x+1=4$
$$x^2-5x=3$$
$$x^2-5x+(\tfrac{5}{2})^2=3+\tfrac{25}{4}$$
$$=\tfrac{37}{4}$$
$$x-\tfrac{5}{2}=\pm\frac{\sqrt{37}}{2}$$
$$\therefore\ x=\frac{5\pm\sqrt{37}}{2}.$$

$$\therefore\ x=0,\ 5,\text{ or }\frac{5\pm\sqrt{37}}{2}.$$

8. RALPHO.—Solve :—

$$\frac{4x}{9}+\frac{x-5}{x+3}=\frac{4x+7}{19}.$$
$$\frac{4x}{9}+\frac{x-5}{x+3}=\frac{4x+7}{19}$$
$$\frac{x-5}{x+3}=\frac{4x+7}{19}-\frac{4x}{9}$$
$$=\frac{36x+63-76x}{171}$$
$$=\frac{63-40x}{171}$$
$$171x-855=189-57x-40x^2$$
$$40x^2+171x+57x=189+855$$
$$40x^2+228x=1044$$
$$x^2+\frac{57x}{10}=\frac{261}{10}$$
$$x^2+\frac{57x}{10}+(\tfrac{57}{20})^2=\frac{261}{10}+\frac{3249}{400}$$
$$=\frac{10440+3249}{400}$$
$$=\frac{13689}{400}$$
$$x+\tfrac{57}{20}=\pm\tfrac{117}{20}$$
$$x=\pm\tfrac{117}{20}-\tfrac{57}{20}$$
$$\therefore\ x=3,\text{ or }-\tfrac{87}{10}.$$

9. P. P.—To do a piece of work A requires $\frac{5}{6}$ as long as B, but A's wages are 1s. a day more than B's. The work costs 22s. more if A does it than if B does it, and if they work together it costs 10 guineas. Find the daily wages of each. (*Intermediate Arts*, 1883.)

Let x = No. of days B takes to do the work,
Then $\frac{5x}{6}$ = ,, A ,, ,,

And let y = B's daily wages in shillings,
Then $y+1$ = A's ,, ,, ,,

Part done by B in 1 day $=\frac{1}{x}$

,, ,, A ,, $=\frac{6}{5x}$,

$\therefore$,, ,, A and B ,, $=\frac{1}{x}+\frac{6}{5x}$
$$=\frac{11}{5x},$$

$\therefore$ A and B together can do the work in $\frac{5x}{11}$ days.

$$\therefore \text{(1)}\ \frac{5x}{6}(y+1) - xy = 22$$
$$\text{(2)}\ \frac{5x}{11}(2y+1) = 210$$
$$\text{(1)}\ 5xy + 5x - 6xy = 132$$
$$\text{(2)}\ 10xy + 5x = 2310$$
$$\text{(1)}\ 5x - xy = 132$$
$$\text{(2)}\ 5x + 10xy = 2310$$
$$11xy = 2178$$
$$\therefore xy = 198.$$

$$\text{(1)}\ 5x - xy = 132$$
$$5x - 198 = 132$$
$$5x = 330$$
$$\therefore x = 66.$$

$$xy = 198$$
$$\therefore y = 3.$$

$$\therefore \text{B's daily wages} = 3s.,\quad \text{A's} \ \text{,,} \ \text{,,} = 4s.$$

General.

1. TONQUIL. — Try *Tebay's* 'Elementary Mensuration for Schools,' 3s. 6d. (Macmillan and Co.); or, 'Complete Treatise on Practical Geometry and Mensuration,' 5s. (Stewart and Co.)

2. A NORMAL STUDENT.—The Answers to the *Certificate Examination Questions* of 1882 have already been given in our pages.

3. H. C. STEDDY. — The Science Examination Questions were published in *The Schoolmaster*, December 23rd, 1882, and May 26th and June 9th, 1883. We know of no complete collection of answers to these two sets of questions.

4. MANCHESTER.—There is *no* rule which justifies the expression, 'Between you and I.' The preposition governs both pronouns in the objective: Between you and me.

5. VELSSERP may study the Principia Latina, or any First Latin Book, so as to acquire a good knowledge of the Accidence. No author is prescribed.

6. SUSSEX.—The question is absurd, as *innumerable* pairs of decimals can be found to fulfil the conditions.

7. M. R. S.—(1) The solution of your query appeared in our issue for January, 1883. (2) For the plural, lbs. should be used.

8. ANXIOUS.—(1) Your query was solved in our issue for July, 1882. (2) Mental Arithmetic is given to First Year candidates only.

9. ANXIOUS.—Such writing should merit between 70 and 80 per cent. Practise the capitals.

10. ORDER.—(1) 'Hygiene'—There is no book published on this subject for the Science and Art Examinations. (2) *Cleland's* 'Animal Physiology,' 2s. 6d. (Collins). (3) *Gill's* 'Plane and Solid Geometry.' (4) *Gill's* 'Second Grade Geometrical Drawing Book.'

11. DORSET is not likely to obtain such details except from an actual *employé*. His writing lacks firmness.

12. HERBERT.—We are not sure as to Male Training Colleges. Enquire at Exeter. The lessons in Latin will be very helpful and will probably suffice. The translations required are simple. See the questions in Latin given last July.

13. QUÆSITOR.—'Marry'=by *Mary;* a term of asseveration.

14. ERO.—The publisher of *Johnstone's* 'Guide,' or of the 'Civil Service Coach,' can give you particulars. Précis is a summary or abstract.

15. H. R. L.—What is meant by the strong and weak forms of declensions of Adjectives in German?

The declension is said to be *strong* if preceded by no Article or Pronoun, and *weak* if preceded by a Definite Article or Demonstrative Pronoun. The general law underlying this system of alteration of inflections is simply a law of euphony to avoid the grating sound that would otherwise arise.

16. ADINA.—The entire history should be studied in a general way, special care and attention to be given to the period named.

17. D. A.—Analyse the following:—

'But while he jested thus
A thought flashed through me,
Which I clothed in act,
Remembering how we three presented maid,
Or nymph, or goddess, at high tide of feast,
In masque or pageant at my father's court.'

Sentence.	Kind.	Subject.	Predicate.	Object.	Extension.
(1) A thought flashed through me.	Principal Sentence	A thought	flashed		through me (place)
(2) Which I remembering clothed in act.	Sub. Adjec. Sentence to 'thought' in No. 1	I remembering	clothed	which (thought)	in act (manner)
(3) While he jested thus.	Sub. Adv. Sentence to 'flashed' of No. 1	he	jested		thus (manner) while (time)
(4) How we three presented maid or nymph or goddess at high tide of feast, in masque or pageant at my father's court.	Sub. Adjec. Sentence to 'I remembering' in No. 2	we three	presented	maid, nymph, goddess	(*a*) at high tide of feast (time) (*b*) in masque or pageant at my father's court (place)

18. TOTA.—Your query was solved in our issue for July, 1882.

19. PRECEPTOR.—'Mei, tui' are substantive pronouns, and are only found after verbs, etc., which are followed by nouns in the genitive case, as 'me tui piget.' 'Sui' is a reflexive pronoun, and refers to the subject of the clause in which it is found. Sometimes 'sui' in a subordinate clause refers to the principal subject, when there can be no ambiguity as to whom it refers. The same remark applies to 'suus.' If the verb of the principal clause be in the passive voice, 'suus' in the subordinate clauses would refer to the subject supposing the principal sentence expressed by means of the active were, as, 'A Cæsare invitor ut sim sibi (Cæsar) legatus.'

The passages for translation would require much paraphrasing to render them into Poetical (not necessarily metrical) Latin. The following is simply a grammatical rendering of the words in prose:—

'Vocem tuam, puercule formose, non audiret; ad te venire ei non licet.'

'Numque mihi frustra vocandum est? (the 'and' must be omitted). Nonne horas per longas, per longas et æstivas, rursus veniet?'

'Oh. Utinam fratrem meum plus amavissem, dum mecum ludebat.'

Mensuration.

1. MUDDLED.—Taking the circumference of a circle at $3\frac{1}{7}$ times its diameter, find the cost of a marble column of 2 ft. breadth, and 5 yards height, marble being at 15s. 6d. per cubit ft. (Area of circle = ½ circumference × semi-diameter.) (*Barnard Smith.*)

$$\text{Solidity of column} = \{(\tfrac{1}{2} \text{ of } 2 \times 3\tfrac{1}{7}) \times (\tfrac{1}{2} \text{ of } 2) \times 15\} \text{ cub. ft.}$$
$$= (3\tfrac{1}{7} \times 15) \text{ cub. ft.}$$
$$= \frac{22 \times 15}{7} \text{ cub. ft.;}$$
$$\text{Cost} = \left(\frac{\cancel{22} \times 15}{\cancel{7}} \times \frac{31}{\cancel{2}}\right)\text{s.}$$
$$= \tfrac{465}{2}\text{s.}$$
$$= 730\tfrac{1}{2}\text{s.}$$
$$= £36\ 10\text{s.}\ 8\tfrac{1}{2}\text{d.} \quad \text{Ans.}$$

[Several Queries are unavoidably held over this month, owing to pressure on our space.]

Publications Reviewed.

The Teacher's Diary and Pocket Book. London: Jarrold and Sons.

Of this useful and handy volume we spoke highly last year. The new edition before us has been greatly improved, and contains many important additions. It embodies in a conveniently summarised form, all the most recent alterations in the Code; the new Music syllabus for the various Standards and for Pupil Teachers; the new Needlework exercises for the examination day; the circular respecting Half-timers, and their registration; and the details as to the mode of examination to be pursued by H.M. Inspectors, and the regulations as to the withholding and representation of children, as contained in the circular from the Education Department, dated August, 1883. Every public elementary teacher should possess a copy.

The Landmark Memory Notes of English History. London: E. W. Allen, Ave Maria Lane.

This book is small enough to be carried in the waistcoat pocket. It contains many valuable facts, so arranged as to be easily committed to memory. It is a useful little summary of English history.

The World at Home Geographical Series. Standard V. London: T. Nelson and Sons.

We cannot better describe this volume than by saying it fully maintains the high merit of its predecessors in the same series. It is emphatically a *Reading* book. The lessons which are interesting, are charmingly and appropriately illustrated, and are supplemented by word-lists, meanings, and summaries. An 'Appendix' and 'Accented List of Names' greatly enhance the value of the book. We unhesitatingly recommend this excellent Standard V. Geographical Reading Book to the profession. It deserves success.

The Royal Map Books. Standards I., II., and IV. London: T. Nelson and Sons.

A remarkably cheap, and we needly scarcely add, excellently got-up series of Map-books, which, in addition to the maps, contain all the *memory-work* necessary for the respective Standards.

Longman's Magazine, October, 1883. London: Longmans and Co.

An exceptionally good number of this popular monthly. The paper by Dr. Richardson on 'Tricycling' is worth twice the price charged for the magazine. Every one interested in 'Cycling' should read it.

The Republic of Books. Book I. By E. C. Hardy, M.A. London: Longmans and Co.

This book is prepared by a schoolmaster, for school boys, and is just what such an edition should be. The notes, which are chiefly grammatical, are printed at the end of the book, a better arrangement for a book to be used in class. There is a valuable introduction with regard to the Platonic Dialogues and their division. A few of the characteristics of Socrates are clearly stated, thereby enabling the student to realise the dialogue. A sketch of the Argument is added, with references to the exact parts of the work where the different portions begin and end. There are three appendices, equally valuable, as to the Sophists, the teaching of Socrates, and the Analogy of the Arts, well worth studying.

Imperial Register of Attendance and Fees. London: Thomas Murby.

Teachers seeking a complete class register could not do better than adopt the Imperial. We can cordially recommend it for the clearness of its ruling, the ample provision made for every requisite, and its suitability for every class of schools. Its compilation has evidently been the work of practical teachers, and if the original instructions given at the beginning are faithfully followed, mistakes will be conspicuous only by their absence. Provision is made for fifty-five names and addresses on each opening, and the trouble of making returns respecting fees will be reduced to a minimum by the use of this register.

Whittington and his Cat: An Operetta adapted for School Festivals. Libretto by A. J. Foxwell, Music by Josiah Booth. London: J. Curwen and Sons, Warwick Lane.

It is gratifying to observe the progress Music is making in our Elementary Schools. The mere parrot-like imitation of melodies sung or played by the teacher, and *got up* by the pupils for an examination, or, in other words, 'singing by ear' fails to satisfy the Education Department; and now, in order to gain the full music grant, the Inspector must certify that the children have been taught to 'sing from notes.' This is a great step in the right direction, and we hope that ere long 'unmusical England' will no longer be the reproach hurled at us by foreign musicians; we believe that teaching music 'by notes' in our schools will gradually bring about a genuine love of the art, a fair amount of musical culture, and good congregational singing in our churches and chapels.

This action of the Department has already called forth a large number of theoretical works, and a fair amount of music adapted to the new requirements; and we cordially welcome all efforts in this direction, among which we may place the 'operetta' before us. The story of Dick Whittington, 'thrice Lord Mayor of London,' possesses a never-failing attraction, and is very well told by the 'librettist,' who evidently found the arrangement of the words a *congenial* task. The music is attractive, easy, and full of variety, and in schools where part-music is attempted (as it *should* be in all schools), the operetta would be very effective at a School Festival or Public Entertainment. The principal solo parts should be taken by the teachers, and the choruses, mostly in two parts, by the children. Two separate choirs, the first consisting of girls and the second of boys, should be trained whenever possible, as in mixed schools.

And here we may remark that it is not at all necessary to restrict school singing to *two* parts. *Three*, and even occasionally *four* parts may be written for with advantage, though it would be unwise to do this continuously. It is a well-known rule that 'the voice parts should have *complete* harmony in themselves,' independently of accompaniments. Attention to this rule, and an occasional division into at least *three* parts, would have prevented the unsatisfactory *fourths* between the two voice parts which we sometimes observe in the choral movements. The piano accompaniment is within reach of any fairly-good reader, and is *interesting in itself*, a fact sufficient to recommend it to the accompanist.

The work is exceedingly well printed; clear, legible, and quite free from typographical errors. This, however, is only what we expect in any book issued by the Messrs. Curwen. A Tonic-Solfa Vocal Score can be obtained for the small sum of sixpence.

Physiography, Advanced. By Andrew Findlater, M.A., LL.D. London and Edinburgh: W. and R. Chambers.

This is an excellent text-book for students of the advanced course in physiography. The various topics are expounded in the order of the syllabus. The illustrations are numerous and well executed. The matter has been carefully selected, and whilst it is not too full, it is of the most recent and reliable kind. Science students will not now need to consult a variety of works for the material of the physiography course; and they will value most highly the concise and trustworthy records here given of the latest results of scientific research.

Burns' 'Cotter's Saturday Night,' and 'The Twa Dogs.'

Scott's 'Lord of the Isles.' Canto VI. Reprints of English Classics. London and Edinburgh: W. and R. Chambers.

These little reprints are carefully got up—nearly half of each page in the former being devoted to notes—chiefly etymological. The notes in the latter are not so copious. Each little pamphlet begins with a short sketch of the author, and in the former there is a very useful and well prepared sketch of the history of the Scottish language, concluding with a list of the principal differences between the Scotch of Burns and modern English.

We heartily commend the former of these books, as a capital book to introduce into any school where the ancient languages are not taught, as a really good educational work.

Shakspere's 'As You Like it.' With Notes, Examination Papers, and Plan of Preparation. London and Edinburgh: W. and R. Chambers.

This is an excellent little publication, well worthy the attention of all who are studying this play. To those preparing for examination, the book will be especially valuable, the notes, introduction, and plan of study being exactly suited to their wants. A series of questions, modelled on those asked at the Civil Service, University, Local, and other examinations, form a fitting ending to a book which has our hearty commendation, and which is well brought out in every respect.

Elementary Mechanics. (First Year's Course.) By J. Williams. London and Edinburgh: W. and R. Chambers.

This little text-book is intended to be placed in the hands of boys about eleven or twelve years of age—at least, so we judge from the last line but one on page five; but we very much doubt whether boys will be greatly attracted by the style and general tone of the work. Yet of all the Fourth-Schedule subjects, mechanics is the one which can be made most interesting to juvenile minds. The writer has omitted to describe such an important instrument as the thermometer, and yet has included a dissertation upon the discoveries of Otto von Guericke, of Pascal, and of Torricelli. We also find repeated all the old confusion respecting 'attraction of gravitation,' 'weight,' and 'gravity'; together with the faulty definition of 'matter,' 'molecule,' etc., as if Tyndall and Huxley had never written anything about these matters. The work is, however, the best of its kind that has yet appeared, and contains much that is calculated to arouse a spirit of thoughtful investigation in the minds of boys.

Shakespeare's Play of King John. For Standards V. VI. VII. World School Series. London: Simpkin, Marshall and Co.

With the exception of the analysing of English sentences, this cheap little volume is adapted for the above standards, to be used not only as a reading-book, but also as one in which the children can find all that they want in preparing for their examination in English. At the end of the play there are some well-prepared tables of affixes and prefixes, showing how words of one part of speech are formed from those of another, and these prefixes and affixes are afterwards divided under their several sources—viz., Saxon, Latin, and Greek.

The play is preceded by an account of the history of the times, printed by the side of the argument of the play itself. The shorter notes and modern equivalents are printed in the margin, the longer notes being placed at the foot of each page. At the end of the play there is (1) a short sketch of the dramatist, (2) a complete list of his plays, and (3) a statement as to the possible source of the play, with a word or two of criticism. What this little book wants to make it of more general use, is a set of questions at the end of every few lines.

Standard School Board Dictionary. London and New York: Ward, Lock, and Co.

This book is spoilt by the palpably cheap way in which it has been brought out. Printed on better paper, with slightly larger type, it would be a most convenient and useful volume; but as it is, its utility is much marred by failure in the above respects. Apart, however, from these failings, we have no fault to find with the book as a dictionary. It contains a vast amount of information, and, as far as we have tested it, is comprehensive and accurate.

The Good Hand Copy-Books. Nos. 1 to 12. London: Ward, Lock, and Co.

We are unable to say that this series is the best we have seen, but they certainly merit commendation. The work throughout is arranged systematically, and shows careful graduation. The 'copies,' too, are essentially practical, being clear, and free from those elaborate flourishes, which but a few years ago were supposed to mark fine penmanship. On the whole, we may say that the series exhibits completeness, and contains nothing that will have to be unlearned.

Poetical Recitations for Standards I.-VII. Granville Series. London: Burns and Oates.

In these five books, an effort has been successfully made to provide lines for recitation which will fulfil the requirements of the class subject 'English' of the Mundella Code. They are on the whole carefully graduated, and the selection is very praiseworthy. Many old favourites will be found in the list, as well as several which have not hitherto found their way into books used in elementary schools. The explanatory notes are clear and precise, and the arrangement of text and notes in parallel columns will facilitate reference and shorten the work of preparation. The selections are ample enough to supply the required number of lines for each standard for several years, and there is not a single piece which is unworthy of being committed to memory.

Standard Poetry. With Explanatory Notes and Biographical Sketches. London and Manchester: John Heywood.

This is a new edition of a book which has long been known to the public. The selection of the poems has been performed with judgment and care, and the result is a poetical reading-book well adapted in subject-matter and style for the use of the upper Standards. A feature of the volume which deserves special mention is that the poems are divided into sections, and each section is preceded by a paraphrase, expressed in clear and simple language, of its contents. The youthful reader is thus enabled to gain a clearer insight into the meaning and scope of the poems than he otherwise would, and is also introduced to what most scholars consider a difficult art—the art of paraphrasing.

A Complete Course of Arithmetical Examples and Exercises. By Thomas W. Piper. London: George Philip and Son.

This book contains a vast amount of examples, supplemented by some entire examination papers, as set at the training colleges and elsewhere. The answers to the questions are neither inserted in the book itself, nor advertised as published elsewhere—an omission which Mr. Piper, no doubt, will speedily remedy. Each set of examples is preceded by an example worked out sometimes in more ways than one. Some of the methods thus given are lengthy and difficult, and in many, using the initials of the quantities discussed, instead of x, the method given is simply the ordinary working of an algebraical problem.

[The Lessons on Music, Notes of a Lesson on the Seasons, Elementary Science, Science Notes, Recent Inspection Questions, and Julius Cæsar Notes, are unavoidably held over this month, and will appear in our next issue.]

BRITISH MUSEUM 2900 83

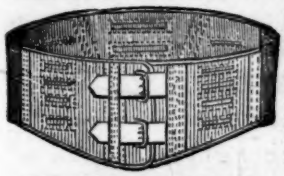
MAGNETINE (DARLOW & CO.'S).

Recommended and used for the Cure of

Spinal Affections	Rheumatism	General Debility	Sciatica	Asthma
Liver Complaints	Rheumatic Gout	Constipation	Lumbago	Neuralgia
Heart Affections	Lung Affections	Hysteria	Hernia	Bronchitis

And other kindred complaints.

GENT'S BELT, 25s.



PAMPHLETS POST FREE.

TESTIMONIAL.

Horton Infirmary, Banbury, Oxfordshire, July 28th, 1882.

DEAR SIR,—I think you will be pleased to learn that in a comparatively short time after wearing your appliances, the pain in the top of my lungs went away, and *has never returned*; also a troublesome, long-standing itching eruption on the back and shoulders disappeared entirely; and I believe these 'good losses,' to speak paradoxically, arose entirely from the use of your Magnetine. - Again, the wearing of your Belt, a short time after putting it on, after breakfast, gives relief—*marked relief*—to a pain in the left side, which has tormented me more or less for many years; of this I can speak most confidently and unmistakably. In conclusion, upon the whole, all through the winter, whilst wearing your Magnetic Soles, I have suffered less with cold feet than heretofore. With kind regards, I remain, dear sir, yours truly,

GEORGE WARE DAVIDS,

The Resident Dispenser, Horton Infirmary, Banbury.

LADY'S BELT, 30s.

PRICE LISTS POST FREE.

DARLOW & CO., 443, STRAND, LONDON.

SPECIMEN OF THE ILLUSTRATIONS.

PHILIPS' HISTORICAL READERS.

Teachers, intending to change their Books, should examine and adopt these Readers, which will be found to produce the best and highest results, not only in History as a Class Subject, but also, by developing the "intelligence" of the children and thus improving "the general quality of the work" (Art. 109b), their use will go far towards securing the highest Merit Grant in addition to the highest History Grant.

GEORGE PHILIP & SON, PUBLISHERS, LONDON & LIVERPOOL.

SCHOOL MUSIC.

J. CURWEN & SONS' NEW PUBLICATIONS.

CODE MUSIC DRILL. Part I., for Standard I. Tonic Sol-fa. Price 2d.

CODE MUSIC DRILL. Part II., for Standards II. and III. Tonic Sol-fa. Price 2d.

CODE MUSIC DRILL. Part III., for Standards IV., and upwards Tonic Sol-fa. Price 2d

CODE MUSIC DRILL. Part IV. Staff Notation. Price 2d.

SCHOOL MUSIC LEAFLETS. Each Leaflet contains a School Song, Sol-fa Notation on one side and Staff Notation on the other. Price 1s. per 100; assorted. 1s. 6d.; single copies, ½d. Nos. 1 to 96 ready. Also in 3 parts, 6d. each. These Leaflets are very handy for School purposes. Detailed list post free.

CODE SINGING TESTS. Tonic Sol-fa. For the Teacher to give vocally, or write upon the Blackboard. Price 6d.

CODE SINGING TESTS. Staff Notation. For the Teacher to give vocally, or write upon the Blackboard Price 6d.

YOUNG VOICES: an Elementary Tonic Sol-fa Course for Schools. 3d.

THE SONGSTER: an Elementary Tonic Sol-fa Course for Schools. 1d.

SCHOOL CANTATAS AND OPERETTAS. 'Red Riding Hood,' 'An Hour in Fairyland,' 'The White Garland,' 'The Flower Queen,' 'The Picnic,' 'The Children's Queen,' 'The Indian Summer,' 'The Twin Sisters,' 'The Birds, and the Fairies,' 'The Rose Queen,' etc. Send for list.

COMPANION FOR TEACHERS: a Handbook for Teachers wishing to study the Tonic Sol-fa system, and teach it in their Schools. Price 1s.

School Music List sent gratis and post free.

London: J. CURWEN & SONS, 8, Warwick Lane, E.C.

SCHOLASTIC MUSICAL INSTRUMENT CO.

(ESTABLISHED 1071).

To supply Teachers, School Board Members, and School Managers with ANY kind of Musical Instrument from ANY Maker at bona fide Trade Price for Cash, or by Easy Instalments.

Every one should read our Circular and Extracts, which are sent Post free.

Apply to the MANAGER, 39 Oseney Crescent, Camden Road, N.W.

'We have now had plenty of time to try the piano; and I can say to you how very much we are pleased with it, and how greatly I am obliged to you for procuring me so excellent an instrument so cheap.'—MATTHEW ARNOLD, Esq., H.M.I.

'You are at liberty to make any use of my wife's and my own opinion—that the piano is excellent both for tone and touch, and that it is a very cheap piano.'—Rev. T. W. SHARPE, M.A., *H.M.I. for Training College for Schoolmasters.*

15,000 similar Testimonials have been received from all parts of the country, from H.M. Inspectors, Assistant Inspectors, Presidents of N.U.E.T., Principals and Masters of Training Colleges, Teachers and School Board Clerks.

THE ONLY ADDRESS IS

39 OSENEY CRESCENT, CAMDEN ROAD, LONDON, N.W.

DRAWING & PAINTING MATERIALS.

Liberal Allowance to Schools. Send for Illustrated Catalogue, Post Free.

BRODIE & MIDDLETON,

79, LONG ACRE, LONDON.

ESTABLISHED 1851.

BIRKBECK BANK.—Southampton Buildings, Chancery Lane.

Current Accounts opened according to the usual practice of other Bankers, and Interest allowed on the minimum monthly balances when not drawn below £25. No commission charged for keeping Accounts.

The Bank also receives money on deposit at Three per cent. Interest.

The Bank undertakes for its customers, free of charge, the custody of Deeds, Writings, and other Securities and Valuables; the collection of Bills of Exchange, Dividends, and Coupons; and the purchase and sale of Stocks and Shares. Letters of Credit and Circular Notes issued.

A Pamphlet, with full particulars, on application.

March, 1880. FRANCIS RAVENSCROFT, Manager.

The Birkbeck Building Society's Annual Receipts exceed Four Millions.

HOW TO PURCHASE A HOUSE FOR TWO GUINEAS PER MONTH, with immediate Possession and no Rent to Pay. Apply at the Office of the BIRKBECK BUILDING SOCIETY.

HOW TO PURCHASE A PLOT OF LAND FOR FIVE SHILLINGS PER MONTH, with immediate possession, either for Building or Gardening purposes. Apply at the Office of the BIRKBECK FREEHOLD LAND SOCIETY.

A Pamphlet, with full particulars, on application.

FRANCIS RAVENSCROFT, Manager.

Southampton Buildings, Chancery Lane.

CIVIL SERVICE APPOINTMENTS.—Rapid POSTAL and CLASS Preparation by Mr. J. KEEFE, F.R.G.S., Civil Service Academy, 6, Colquitt Street, Liverpool. The System is essentially individual, and involves (*a*) a thorough study of Text-Books, each subject being so divided as to render easy its rapid acquisition by the student; (*b*) an Exhaustive Treatment of the Latest Examination Papers. Recent successes:—*Excise*—16th, 18th, 19th, 21st (twice), 33rd, 36th, 51st, 57th, 84th, etc.; *Men Clerks*—19th, 37th, 41st, 45th, 49th, etc.; *Customs*—5th, 24th (twice), 25th, 29th, 35th, 40th (twice), 45th, etc.; *Boy Clerks*—16th, 18th, 40th, 45th, 53rd, 60th, etc., etc. Prospectus on Application.

LANDMARK MEMORY NOTES OF ENGLISH HISTORY.

PRICE SIXPENCE.

VERY favourable opinions of this work have been received from the President and Vice-President of the National Union of Elementary Teachers; the President and Vice-President of the Manchester Teachers' Association; G. G. Zerffi, Esq., Ph.D., F.R.S.L., Chairman of the Council of the Royal Historical Society; Miss Annie Kemm, Fellow of the Royal Historical Society, Whitelands College; and many others. *The School Board Chronicle* says: 'Students preparing for examination will do well to work by the Notes.'

LONDON: E. W. ALLEN, AVE MARIA LANE, E.C.

TUITION BY CORRESPONDENCE. CERTIFICATE EXAMINATION.—Graduated instruction, suitable exercises, careful corrections, and ample solutions are provided regularly twice a week. The terms are either quarterly (from 10s. per quarter) or by results (from £1 upwards), according to preference. Pupils who prefer the quarterly arrangement remit the fee at the end of the quarter; those who select 'payment by results' receive their instruction gratuitously *unless a pass is secured*.

MATRICULATION (established 1871).—As explained in recent advertisements, this is practically the only opportunity of obtaining suitable and sufficient instruction from Tutors who devote their whole time to the work, and who require *no payment whatever* if the pupil fails after two attempts.

CIVIL SERVICE.—Scholarship, A.C.P., Diocesan, Shorthand, P.T. Papers, Science, Drawing, Musical, Medical, Legal, and all other branches as usual. Terms, quarterly or 'by results,' at the option of the pupil.

Address, Mr. JAMES JENNINGS, Tuition by Correspondence Office, Deptford, London.

'BANKRUPT STOCK.'

G. E. HAWES,

SCHOOL DESK MANUFACTURER,

Having purchased the Entire Stock of Iron Standards manufactured by

JOHN GLENDENNING,

Late of Chalk Hill Works, trading under the name of

COLMAN & GLENDENNING,

IS NOW OFFERING THE CELEBRATED

NORWICH DESKS

AT GREATLY REDUCED PRICES.

For particulars apply to the above, at

CHAPEL FIELD

OR

DUKE'S PALACE WORKS,

NORWICH.

Maker to the Birmingham School Board.

PROFESSOR BAIN'S

COURSE OF ENGLISH,

For both Primary and Higher Schools.

REVISED EDITIONS.

	s.	d.
First English Grammar	1	4
Key, with Additional Exercises	1	9
Higher English Grammar	2	6
Companion to the Higher Grammar ...	3	6
English Composition and Rhetoric... ...	4	0

London: LONGMANS & CO.

SECTIONAL PAPER,

With Garments drawn, 3rd or 4th year, 1s. 6d. each. Plain Sectional, 3d.

CUTTING-OUT by proportions. Instructions with three patterns, 1s. 6d. Stocking scale, 7d.

MISS GROUT, 4, Howard Street, Poplar, E.

BORD'S PIANOS
ON SALE
WITH 25 PER CENT DISC! FOR CASH,
OR 15/- PER MONTH ON THREE YEARS' HIRE SYSTEM,
SECOND HAND ON 3 YEARS' SYSTEM 10/6
PER MONTH ILLUSTRATED LIST FREE OF
PLANOFORTE MAKER
Chas. Stiles & Co
42 SOUTHAMPTON ROW, HOLBORN, LONDON W.C.

HEADS OF SCHOOLS AND OTHERS ENGAGED IN TUITION SHOULD APPLY FOR

ALLMAN'S
CATALOGUE OF SCHOOL PRIZES AND REWARDS.

A LIST OF SEVERAL HUNDRED BOOKS,

Offered to the Scholastic Profession only at a discount varying from 25 to 75 per cent.

Sent post-free on application to

ALLMAN & SON, 67, New Oxford Street, London, W.C.

ILLUMINATED LABELS FOR AFFIXING IN PRIZE BOOKS GRATIS TO PURCHASERS.

EYRE & SPOTTISWOODE'S

MATHEMATICAL DRAWING INSTRUMENTS,

WATER-COLOURS, OIL-COLOURS,

And all Drawing Materials suitable for Technical and Art Students:

BEST TOWN-MADE DRAWING INSTRUMENTS,

As used in Public Schools.

EYRE & SPOTTISWOODE,

London—Great New Street, Fleet Street, E.C.

MANSFORD'S MATHEMATICAL WORKS.

By CHARLES MANSFORD, B.A., Vice-Principal of the Westminster Training College.

Mansford's School Arithmetic. Price 4s. 6d.

The entire subject is logically arranged; and the explanations given indicate the proper methods of teaching the rules, and also present a convenient summary of the principal points to be remembered by the pupil.

The best methods of working are fully explained and illustrated, and the rules are printed at length and in different types. Most of the examples are taken from the Papers set by the Education Department during the past twenty years.

The *Schoolmaster* says:—'We can strongly recommend it to the attention of our readers.'

The *School Board Chronicle* says:—'The commercial part is as good from the practical point of view as the theoretical is from the scientific standpoint. It is a capital Arithmetic; novel, without being far-fetched or over-ingenious.'

Mansford's School Algebra. Price 1s. New Edition.

Is specially adapted for Pupil Teachers, and contains *full explanations* of the points likely to prove difficult to beginners. There are numerous original examples, especially in problems, which are carefully classified and graduated. *The relation of the subject to Arithmetic is kept constantly in view, and illustrated throughout.*

Adopted by the London School Board. New Edition.

Mansford's Algebra for Elementary Schools. Price 6d.

Mansford's School Euclid. Books I. and II. Price 1s.

In this little Manual the propositions are so arranged as to bring out the relation of the several parts. Exercises and explanatory *notes* are appended to *each* proposition, and the diagrams have been specially engraved to show the distinction between the constructive parts and the data. A series of one hundred miscellaneous exercises, *classified according to the propositions on which they depend*, is given at the end.

Now ready, price 2s. 6d.

Mansford's Solution of Geometrical Exercises, Explained and Illustrated. With a Complete Key to the School Euclid, and 100 Additional Examples.

This Key has been prepared specially for Teachers who use the School Euclid. It contains the Solution of all the Examples in the Text Book, and also of 100 Additional Examples, which are so arranged that a Teacher can select a suitable exercise for any proposition.

Mansford's Mental Arithmetic for Schools and Training Colleges. Price 1s. 6d.

The rules and examples are systematically arranged and graduated. Each page contains a single rule, with its proper illustrations and accompanying examples.

The miscellaneous examples contain a complete set of the Certificate Examination Papers in Mental Arithmetic, both for Male and Female Candidates, from the beginning. The Answers at the end may be relied upon.

*** The New Editions of Mr. Mansford's Algebras contain Additional Chapters, with numerous Examples on FACTORS These Algebras will be found thoroughly adapted to the most modern requirements both of Elementary and Middle-class Schools.*

*** SPECIMENS SENT POST FREE ON RECEIPT OF PUBLISHED PRICE IN STAMPS.*

JOSEPH HUGHES, Educational Publisher, Pilgrim-street, Ludgate-hill, E.C.

JOHN HEYWOOD'S CATALOGUES.

The following Catalogues will be sent Post Free on Application.

I.—A Catalogue of EDUCATIONAL AND MISCELLANEOUS WORKS,
Containing a list of John Heywood's own distinctive Publications. This will be found to embrace a great variety of Educational Works (written mainly by practical authors), and from it heads of schools and others may select books in almost every branch of study.

II.—An Illustrated Catalogue of CHURCH AND SCHOOL FURNITURE.
A Handy Guide for Architects and Builders of Schools, as well as for the Clergy, School Boards, School Managers, and Teachers.

III.—A Classified and ILLUSTRATED EDUCATIONAL CATALOGUE,
Containing a general list of the leading School Books published, together with the most commonly-used articles in Stationery and Materials.

IV.—A Catalogue of JUVENILE AND OTHER WORKS
Suitable for Presents, Prizes, Libraries, and General Reading.

V.—A Catalogue of DRAWING MATERIALS,
Comprising Oil and Water Colour Paints, Colour Boxes, Oil and Varnishes, Brushes, Canvases, Academy and Millboards, Blocks, Drawing Boards, Mathematical Instruments, with every variety of material to meet the requirements of artists.

VI.—A Catalogue of BOOKS AND PAMPHLETS,
Containing Dialogues, Lectures, and Recitations, some of which are in the Lancashire Dialects, suitable for Public Readings and Private Entertainments.

VII.—A Catalogue of KINDERGARTEN MATERIALS,
Specially selected and prepared to meet the requirements of the Mundella Code, comprising the following: Kindergarten Desks and Furniture, Kindergarten Publications, Kindergarten Gifts and Amusements, Paper-plaiting and Peas Work, Stick Laying, Wood and Cork Making, Form and Colour Materials, and every description of Educational Appliances.

JOHN HEYWOOD, Publisher, Deansgate and Ridgefield, Manchester; and 11, Paternoster Buildings, London.

NEW COPY-BOOKS, in 16 Parts.—Price 2d. each.

A SERIES OF

PRACTICAL STANDARD COPY-BOOKS.

BY JOSEPH COX,

Head Master of the Talbot Lane Schools, Rotherham.

SPECIAL FEATURES.

1. The copies are set in a bold, natural hand, not too much sloped, with looped letters of moderate length.
2. The mode of forming the most difficult letters is clearly shown.
3. The arrangement is so simple that a scholar cannot possibly have any doubt as to what he has to do—thus saving the teacher's time.
4. A complete training is afforded to **Standards II.** and **III.** in the art of '**Working an Examination Paper in Arithmetic.**'
5. Practical hints are freely given, especially in the earlier numbers, for the guidance of both Pupil Teachers and Scholars.
6. The books are carefully graduated, and great variety is afforded in the Higher Standards where it is most needed.

STANDARD I.

No. 1. Elements, Letters, and Simple Combinations.
Medium Large Hand.

No. 2. Letters, and Easy Words formed rom them.
Medium Large Hand.

No. 3. Short Easy Words formed of letters not going above or below the line.
Medium Large Hand.

STANDARD II.

No. 4. Short Words in common use containing Loop Letters.
Full Text.

No. 5. Short Words in common use, each commencing with a Capital Letter.
Medium Text.

No. 6. Bold Small Hand in Double Lines—Geography and Grammar.
A thorough training given in working the Arithmetic of Standard II. on paper.

STANDARD III.

No. 7. Bold Small Hand in Double Lines. Narrative.

No. 7½. Capitals and Figures. Large Hand and Small Hand in double lines.

No. 8. Small Hand—Double Lines—Grammar and Geography.
A thorough training given in working the Arithmetic of Standard III. on paper.

STANDARD IV.

No. 9. Full Text and Small Hand in Double and Single Lines—Geography.

No. 10. Small Hand—Single Lines—Narrative.

STANDARD V.

No. 11. Small Hand—Single Lines—Geography.

No. 12. Small Hand—Single Lines—Poetry.

STANDARD VI.

No. 13. Small Hand—Single Lines—Geography.

No. 14. Commercial Forms—Letters.

No. 15. Finishing Hand for Boys or Girls.

London: JOSEPH HUGHES Pilgrim Street, Ludgate Hill, E.C.

EDUCATIONAL WORKS PUBLISHED BY THOMAS MURBY.

MURBY'S HISTORICAL READING BOOKS.

Graphically Written and fully Illustrated.

Whether in the matter of text, illustrations, typography, paper, or binding, it is believed that these books will be found second to none, and superior to most of those now before the public.

I.—Now Ready.

STORIES FROM THE HISTORY OF ENGLAND, from Julius Cæsar to Wellington. 144 pp., extra fcap. 8vo, 9d., cloth boards; 6d., cloth limp.

II.—Now Ready.

A SIMPLE SKETCH OF THE HISTORY OF ENGLAND, from the time of the Britons to the Crimean War, 192 pp., extra fcap. 8vo, 1s., cloth boards; 8d., cloth limp.

MURBY'S GEOGRAPHICAL READING BOOKS.

In accordance with the Mundella Code.

Now Ready.

BOOK I.—To explain a Plan of the School and Playground, the Four Cardinal Points, the Meaning and Use of a Map. With Numerous Maps and Illustrations. 64 pp., fcap. 8vo, cloth limp, 4d.

Other Volumes in preparation.

Now Ready.

ELEMENTARY PRINCIPLES OF AGRICULTURE.

By Albert Carey, F.R.G.S., Author of 'Principles of Agriculture.'

STAGE I., FIRST YEAR'S COURSE ... ... 4d.
STAGES II. AND III., SECOND AND THIRD YEARS' COURSES... 6d.
THE THREE STAGES COMPLETE, IN CLOTH ... ... 8d.

IMPERIAL READING BOOKS.

Imperial Primer. Very large type, 32 pp. Twenty-six Illustrations, cloth, 3d.

First Imperial Reader. Post 8vo, 96 pp., Cheap Edition, 6d.; extra cloth boards, 8d.

Second Imperial Reader. Post 8vo, 128 pp., extra cloth boards, 9d.

Third Imperial Reader. Post 8vo, 192 pp., extra cloth boards, 1s.

Fourth Imperial Reader. Post 8vo, 256 pp., extra cloth boards, 1s. 4d.

ADVANCED EXCELSIOR READING BOOKS.

Bk. I., 96 pp. fcap. 8vo, cloth bds., 6d.
„ II., 128 pp. „ „ 8d.
„ III., 192 pp. „ „ 10d.
Bk. IV., 288 pp. post 8vo, cl. bds., 1s. 3d.
„ V., 320 pp. „ 1s. 6d.
„ VI., 448 pp. „ 2s. 0d.

Excelsior Primer, 64 pp., 4d. and 3d.

Both the above sets of Reading Books are in accordance, as regards size, etc., with the recent circular of the Department to H.M. Inspectors.

MURBY'S IMPERIAL COPY BOOKS.

'Excellent.' — *These Superior Copy Books are rapidly finding their way into all good schools.* — 'Unexcelled.'

The following new numbers have lately been added:—
No. 3½, Text and Large Text, } Making in all seventeen numbers.
No. 5½, Large Hand and Small. } Price 2d. each.
No. 12½, Girls' Finishing Hand. } **** Specimens on application.

MURBY'S SCRIPTURE MANUALS. GENESIS, enlarged Edition, price 9d. Containing upwards of 40 pages of additional Notes culled from the most eminent authorities. The Series also includes EZRA (enlarged) and NEHEMIAH, 9d.; JOSHUA and JUDGES, 9d.; JOSHUA (enlarged), 9d.; JEREMIAH, 6d.; ST. MARK, 6d.; ST. LUKE, 9d.; ACTS (with Map), 9d.; 1st CORINTHIANS, 1s.; CHURCH CATECHISM (enlarged), 6d.; BOOK OF COMMON PRAYER, 1s.; etc.

ALGEBRA FOR BEGINNERS. New Edition, enlarged. In 4 parts. I. and II., 2d. each; III. and IV., 3d. each; complete 10d. Answers, 6d.

'I am much pleased with your Algebra, which I have used for several years with much success. It is now one of the best books for general school work I know of.'—John Sarll, *Beauvoir Coll., St. Leonards.*

MENSURATION FOR BEGINNERS. By W. Dodds, Author of 'Algebra for Beginners,' etc., 1s.; with Answers, 1s. 4d. Part I., Squares, Rectangles, and Triangles, 4d.

'A useful book; the diagrams are plentiful, the explanatory portions clear, and the examples abundant.'—*Schoolmaster.*

MURBY'S SILICATE BOARD-SLATES. Improved make. Superior to slate at about half the cost. Light, durable, and convenient.

SIZES AND PRICES.

Size.	Framed.	Framed, and Swung on Folding Stands.
33+28	6s. 0d.	—
38+30	7s. 0d.	21s. 0d.
43+36	8s. 0d.	24s. 0d.
50+36	11s. 6d.	30s. 0d.

**** Ruled for Music or Writing, 2s. per side extra.

DR. DICK'S GEOGRAPHY AND ATLAS. A First Book of Political Commercial, and Historical Geography, corrected to date. Price 2s. The Same without Maps, 1s. 6d., cloth boards.

MURBY'S IMPERIAL DRAWING BOOKS.

ADAPTED TO THE SOUTH KENSINGTON COURSE.

Price 2d. each.

Book I.—Freehand. Easy Common Objects.
Book II.—Freehand. Ornaments, Vases, etc.
Book III.—Freehand. Test Papers.

Books I. and II. provide material for training in class work and for individual practice. Book III. supplies a series of Tests for ascertaining the progress of the pupil.

SPECIMENS GRATIS.

'The simplicity, good style, and good arrangement of these examples are excellent points, and the book, which is very cheap, is likely to be as useful as a Drawing Copy can be.'—*Athenæum.*

MURBY'S IMPERIAL GRAMMAR AND ANALYSIS.

SPECIALLY PREPARED FOR THE MUNDELLA CODE.

Extra fcap. 8vo, 144 pp., cloth boards, 1s.; cloth limp, 10d.

This work affords (1) a graduated series of lessons, (2) a systematic course of exercises, special prominence being everywhere given to the so-called 'difficulties' of the subject.

For the convenience of pupils it is issued in Parts as follows:—

Standard II., 16 pp., ½d. | Standard IV., 32 pp.... ... ... 2d.
Standard III., 16 pp., 1d. | Standards V., VI., & VII., 80 pp. 6d.

**** The work has been adopted as the text-book in one of the largest Middle-class Schools of London.

RAPID COMPUTATION.

A NEW COURSE OF MENTAL ARITHMETIC.

By J. BAINES, B.A. (London).

With Introductory Stages and Hints on Method.

By J. T. PRINCE.

Standards I. & II., 16 pp. 1d. | Standard IV., 24 pp. ... ... 1½d.
Standard III., 16 pp. ... 1d. | Standards V. & VI., 40 pp. ... 3d.

LANGTON'S EXAMPLES IN ARITHMETIC.

By J. LANGTON, M.A.,

Late Principal of the Darlington Training College.

Standard I., 24 pp., price 1½d. | Standard IV., 24 pp., price 1½d.
Standard II., 24 pp., price 1½d. | Standard V., 24 pp., price 1½d.
Standard III., 24 pp., price 1½d. | Standard VI., 24 pp., price 1½d.

STANDARD VII. in preparation.

Answers to the above, price 2d. each Standard.

CONNECTION OF GEOGRAPHY AND ASTRONOMY. By Dr. A. H. Dick. Price 1s.

THE GUIDE TO SPELLING DIFFICULTIES. By John Russell. Price 1s.

HANDBOOK OF ETYMOLOGY. Price 6d.

MANUAL OF ENGLISH LITERATURE; OR, CHAUCER TO WORDSWORTH. By Thomas Arnold, M.A. 470 pp., extra fcap. 8vo. New Edition. Price 3s.

WORMELL'S SHILLING SCHOOL ARITHMETIC. Including all the Commercial Rules, 224 pp., price 1s. With Answers, 1s. 6d.

THE SCHOOL AND COLLEGE ARITHMETIC. By Dr. Wormell. 300 pp., price 2s., cloth boards. With Answers, 3s.

*** The most Comprehensive School Arithmetic issued.*

THE COMMERCIAL CORRESPONDENT. For Schools and the Counting House. Fifth Edition, enlarged. Price 1s. 6d. Nearly ready.

ANALYSIS OF ENGLISH HISTORY. New Edition, 1s., and 1s. 6d. cloth. With Biographical Appendix, 1s. 3d., or 1s. 9d. cloth.

IMPERIAL HANDBOOKS OF ENGLISH HISTORY. By the Rev. R. O. Thomas.

THE TUDOR PERIOD ... ... 1s. 6d.
THE NORMAN PERIOD ... ... 1s. 0d.

With Genealogical Tables, Maps, Illustrations, and all other notabilia required for thoroughly 'getting up' the period in question.

MAPS AND CHARTS OF ENGLISH HISTORY. The Norman and Plantagenet Periods to the end of the Crusades. 48 in. by 39 in. Price 10s. 6d.

OVID'S METAMORPHOSES. Book XIII., etc. For London University Matriculation Examination. With very full Notes and Vocabulary. By C. Bilton, B.A. Price 2s. 6d.

EASY LATIN COURSE. Books I., II., III., and IV., 6d. each. Complete, cloth, 2s. Key, 6d.

MUSICAL STUDENT'S MANUAL. By T. Murby. Crown 8vo, 228 pp. 3s. 6d. each.

JUST PUBLISHED BY
W. & R. CHAMBERS.

GRADUATED READERS, an entirely New Series. Illustrated.

		s.	d.			s.	d.
Book I.	96 pages ...	0	6	Book III.	176 pages ...	1	0
„ II.	128 „ ...	0	8	„ IV.	232 „ ...	1	3

ENGLISH CLASSICS. *New Editions.* With copious Notes.

Burns's Cotter's Saturday Night, Twa Dogs, etc.	0	2	Milton's L'Allegro, Il Penseroso, and Lycidas	0	2
Byron's Prisoner of Chillon	0	2	Scott's Lady of the Lake, Cantos I., II., V. ... ... each	0	2
Coleridge's Ancient Mariner	0	2	Scott's Lord of the Isles, Cantos I., VI. „	0	2
Macaulay's Armada, Ivry, and Evening ...	0	2	Wordsworth, The Brothers	0	2
Milton's Paradise Lost, Book I.	0	2			

CHAUCER'S CANTERBURY TALES. With Notes, Glossary, and Examination Papers.

The Prologue	1	6	The Squieres Tale	1	6
The Clerkes Tale			1s. 6d.		

SHAKESPEARE'S AS YOU LIKE IT. With Introduction and copious Notes.

COMPOSITION. Being Short Themes on Easy Subjects for Standards VI. and VII. By A. PARK, F.E.I.S. 0 6

COMPOSITION, Test Cards for Standards VI. and VII. (corresponding to the Short Themes). By A. PARK, F.E.I.S. 36 Cards in cloth case 1 0

OUTLINE OF THE HISTORY OF THE ENGLISH LANGUAGE AND LITERATURE. Being a History of the Grammar and of the Vocabulary, with Roots, lists of leading Authors and their works, Figures of Speech, etc. 0 8

MECHANICS. Stage I. By J. WILLIAMS, Swindon 0 6

LATIN—FIRST YEAR'S COURSE. Limp, 6d.; boards 0 8

LATIN—SECOND YEAR'S COURSE. Limp, 6d.; boards 0 8

FRENCH—FIRST YEAR'S COURSE. (Nearly Ready.)

PRINCIPLES OF AGRICULTURE. By W. T. LAWRENCE. Illustrated.

Stage I.	0	2	Stage III.	0	3
„ II.	0	2	In one volume, cloth	0	10

ADVANCED PHYSIOGRAPHY. Adapted to the Syllabus of the South Kensington Science Department. By A. FINDLATER, LL.D. 1 6

W. & R. CHAMBERS, 47, Paternoster Row, London; and Edinburgh.